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5 SEPTEMBER 1986

China Report

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT--52

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CHINA REPORT

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POWER SECTOR STRUGGLES TO KEEP UP WITH EXPANDING ECONOMY

HK050800 Hong Kong LIAOWANG OVERSEAS EDITION in Chinese No 26, 30 Jun 86 pp 16, 17

/Article by Lu Zhongyun /4151 0112 0061/ and Chen Ming /7115 2494/: "China's Energy Industry Shoulders Heavy Burden as the Pacesetter"/

/Text/ The coming 5 years is a crucial period for laying a foundation and building reserves for the overall revitalization of China's national economy in the 1990's. In these 5 years, what will the development of the energy industry be like as the foundation of the national economy, and can it provide enough energy for a still bigger leap forward in China's economy? To find an answer, we visited the three ministries related to the energy industry--the Ministry of Water Resources and Electric Power, the Ministry of Coal Industry, and the Ministry of Petroleum Industry.

Simultaneous Development of Thermal, Hydroelectric, and Nuclear Power in Effort to Reverse the Electricity Shortage

On the current situation of the electric power industry, Minister of Water Resources and Electric Power Qian Zhengying spoke briefly and to the point in an assessment: The situation is very favorable and the shortage of electricity is serious. She said: "Our shortage of electricity is a shortage given a very favorable situation in the national economy, and is a result not of too-slow development of electric power but the accelerated pace of the development of the national economy." According to an estimate, the shortfall of electric power throughout the country in 1985 reached 12 million kilowatts with electric output standing at 45-50 billion units. The shortage-affected area extended from the coastal and central areas of China to inland and northwestern areas. A large number of factories stopped production because of power restrictions. There was no guarantee for the availability of electricity for the people in their everyday life. Moreover, in the coming few years, the shortage of electric power supplies is likely to become more acute. Therefore, to resolve the knotty problem of electric power shortage is a tremendous task facing electric power departments during the Seventh 5-Year Plan period (1986-1990).

The central authorities long ago laid down a clearcut rule that the development of the energy industry must focus on electric power. During the Seventh 5-Year Plan, China's electric power industry will show relatively big development. In

5 years, the scale of power station construction will reach 54.9 million kilowatts, with installed generators put into production accounting for 34.4 million kilowatts. This means an average annual output of about 7 million kilowatts based on generators put into production, more than double that during the period of the Sixth 5-Year Plan (1981-1985). By 1990, the national electric output will reach 550 billion units, an increase of 142.7 billion units over 1985.

Given the conditions of China's resources, the guidelines for electric power development during the Seventh 5-Year Plan period calls for energetically developing thermal and hydroelectric power and the building of nuclear power plants in a selected and systematic manner. Thermal power chiefly involves the building of a number of mining-area power plants in Shanxi, Nei Monggol, Heilongjiang, Guizhou, and other main coal-producing areas, the building of a number of harbor power plants in coastal areas that have easy access to coal shipments and are close to peak load centers. Hydroelectric power focuses on continuously tapping water resources, such as the main and tributary streams of the upper reaches of the Hugnahe River, the middle upper reaches of the Chang Jiang River, and the Hongshui He River Valley, in buidling a number of large-sized hydropower stations. A number of medium-sized hydropower stations are also to be built in northeast China, east China, and other areas. Nuclear power calls for the completion of the first stage of the nuclear power station of Qinshan, Zhejiang, and the continuous building of the Guangdong nuclear power stations.

Whether the shortage of power in China in the 1990's will be eased or exacerbated chiefly depends on whether the Seventh 5-Year Plan is implemented in a satisfactory of unsatisfactory manner. It should be noted that many favorable conditions and factors exist. First, the state will gradually raise the proportion of money invested in electric power development and will render energetic support for it where policy is concerned. Second, the electric power departments are carrying out reforms to stimulate development. In a bid to overfulfill the Seventh 5-Year Plan, they are taking various positive measures: To strengthen the effort to raise funds for the building of electric power projects, tap more sources of funds, and induce myriads of households to get involved with such projects; to reduce the costs of building projects, shorten the period of work, and accelerate the pace of electric power development; and to take good care and make good use of existing equipment and power networks, so that limited available equipment can produce a still greater effect.

In addition, during the Sixth 5-Year Plan period, China's energy industry entered the new stage of big units, extra-high voltage, and large networks. In 1985, China's actual electric energy production reached 408.5 billion kWh, an amount of generated energy ranking fifth in the world. At the end of 1985, the total national capacity of installed generators had reached 86.29 million kilowatts, The achievements scored by the electric power industry during the Sixth 5-Year Plan have laid a foundation for the implementation of the Seventh 5-Year Plan. Therefore, we have every reason to believe that things will go better than expected with the implementation of the Seventh 5-Year Plan. Prospects for the development of the electric power industry are bright.

Coal: Tap the Potential, Pave the Way for Smooth Flow of Coal and Climb "One Flight of Steps Higher"

Coal has traditionally been China's main source of energy. According to latest data, coal still accounts for as much as 70 percent of what constitutes China's three big sources of energy. Relevant experts believe that there will not likely be a big change in such a percentage before the year 2000 or even 2050, as based on an estimate. Therefore development of the coal industry has a great bearing on the development of China's energy and a farreaching effect on the progress of the "four modernizations."

During the Seventh 5-Year Plan period, the objectives in the development of the coal industry are: A national average annual increase of 40 million tons of raw coal in coal production, the annual output in 1990 to reach 1 billion tons, an increase of 200 million tons over 1985; and the concentration of financial and material resources in capital construction on building new and expanding a large number of mines, the investment of 31.5 billion yuan to be completed, the scale of mines being worked upon to reach 180 million tons, and the total capacity of mines put into production to reach 167 million tons. Moreover, proper attention will be paid to survey and prospecting in priority areas, reserves for the industry to be increased by 20-25 billion tons, and newly added proved reserves to reach 50 million tons.

A reliable projection for the future must be based on a rational assessment or analysis of realities. China has extremely abundant coal resources. This has laid a strong foundation for the great development of the coal industry. Of proved energy reserves, coal deposits reach as much as 770-odd billion tons, or around 90 percent. Of the 2,000-plus counties (cities) throughout the country, more than half have coal deposits. The large coal-producing areas of the country, such as Shanxi, Nei Monggol, Xinjiang, Guizhou, and so forth, are world famous for their deposits. Proved deposits in Shanxi Province reach more than 200 billion tons, ranking first in the country. In recent years, many large and small coalfields have been successively found. It can be seen that there are infinite prospects for coal mining.

After more than 30 years of construction, China's coal industry has operated on quite a large scale. During the Sixth 5-Year Plan period, the coal industry showed especially great development. In 1983, national raw coal output reached 715 million tons. This meant a big step forward with an annual output of 700 million tons. In 1985, there was another big step forward with an annual output of 800 million tons, ranking second in the world. During the Sixth 5-Year Plan period, China also built and put into production a number of large and medium-sized coal mines, with newly verified coal deposits reaching 110 billion tons. The degree of mechanization had been considerably raised. By 1985, the degree of mechanization for coal mines under unified control had been raised to 45 percent. In this period, local coal mines also showed great development, with the production capacity showing an average annual increase of more than 34 million tons.

To ensure the development of the coal industry during the Seventh 5-Year Plan period, the relevant departments of the Ministry of Coal Industry and the State Council are actively taking measures:

--We must rationally define the principle about the distribution of the coal industry and the guideline for development, and put the technical reform of mines in the first place, making priority arrangements for the alteration, expansion, and building of mines. We must make proper arrangements for projects under construction carried over from the Sixth 5-Year Plan, so that these projects can be completed and put into operation at an early date and play their proper role. Meanwhile, we must properly arrange for a number of medium-sized and small mines that allow a small investment but quick results, and seek the production of coal ahead of time to guarantee the fulfillment of the output quota for the Seventh 5-Year Plan. We must actively render support for the development of local mines and enable them to play a still greater role under the Seventh 5-Year Plan period.

--We must raise funds from many quarters. 1) We must rely on the state's support and its policy of providing preferential treatment. 2) The Ministry of Coal Industry must raise funds through various channels. 3) We must insist on using foreign investments and strive to further expand a number of construction projects by using foreign money during the Seventh 5-Year Plan period.

--We must strive to improve communications and transportation conditions, seek the simultaneous development of newly built coal transportation lines, railroads, and water routes, and guarantee the smooth flow of coal to other areas.

So long as we effectively carry out these measures, make the most of various conditions, and overcome difficulties, the goals of the Seventh 5-Year Plan can be attained.

Petroleum: We Must Vigorously Work on Prospecting, Ensure Output, and Further Develop the Grand Plan

Despite a late start, China's petroleum industry has shown rapid development. In the past 30 years and more, 22 provinces, municipalities, and autonomous regions have discovered oil and natural gas. More than 180 oil fields have entered the stage of exploitation. Among these are a number of extra large oil fields, such as Daqing, Shengli, Zhongyuan, Huabei, and so forth.

During the Sixth 5-Year Plan period, China's annual crude oil output remained stable at all times above the level of 100 million tons. Total crude oil production in 5 years reached 548 million tons. A new situation was also brought about in oil prospecting. A great future opened up for China's oil exploitation. During the Sixth 5-Year Plan period, more than 30 relatively large belts with rich oil and gas concentrations were successively discovered. Newly proved geologic oil reserves stood at 3.1 billion tons. At present, the area already prospected for oil in China has reached more than 5 million square km. There have been continuous new discoveries. Meanwhile, natural gas prospecting has also shown development. After prospecting in eight areas, including Zhongyuan, the Beijing-Tianjin-Tangshan-Liaoning area, the Shaanxi-Gangsu-Ningxia Basin,

the Sichuan Basin, and so forth a number of high-yield oil and gas fields were successively discovered. In recent years, China has strengthened cooperation with foreign countries and gradually develop offshore oil prospecting and has discovered 23 oil gas flow structures, providing favorable conditions for the further development of offshore oil fields. All this has enabled the realization of the goals of the Seventh 5-Year Plan to rest on a solid foundation.

The Ministry of Petroleum has clearly spelled out the guideline for the development of the oil industry during the Seventh 5-Year Plan period: 1) We must insist on putting prospecting in the first place and do all we can to ensure fulfillment of the task of increasing oil and natural gas reserves. 2) We must guarantee fulfillment of the crude oil and natural gas production plans and strive to create conditions for the realization of a benign production cycle in the petroleum industry. 3) We must actively stimulate technical progress and technical reform and ask speed, quality, and efficiency of science and technology.

In line with the demands of the Seventh 5-Year Plan, national crude oil output must reach 150 million tons by 1990, an increase of 25 million tons over 1985. Natural gas output is to reach 15 billion cubic meters. Meanwhile, it is also stipulated that we must in 5 years increase crude oil exploitation capacity by 60 million tons and increase natural gas exploitation capacity by 3 billion cubic meters. We must also increase geologic oil reserves by nearly 7 billion tons and geologic natural gas deposits by more than 800 billion cubic meters.

It can be seen that the burden on oil industry departments in the coming few years is quite heavy. Moreover, many obstacles still stand in the way of the development of the oil industry, such as the need for further improvement in the proportionate relations between deposits and output and the need for still a large amount of work in turning resources into deposits and deposits into output. In addition, there are such obvious contradictions as gaps in engineering, poor management, shortage of funds, and so forth. All these are factors restraining the development of the oil industry and cannot be overlooked.

The above is a brief description of the status quo of China's energy industry and its prospects. The momentum of the development of the energy industry itself is satisfactory, but as far as the current demands of the whole national economy on energy area concerned, we cannot be too optimistic. How to make up for the shortfall in energy supplies and resolve the contradiction between supply and demand and to bring about the simultaneous development of the energy industry and the whole national economy and society in a well-coordinated manner--this remains an outstanding problem that must be urgently solved by China at present and in the future.

/12228
CSO: 4013/148

ENERGY, TRANSPORTATION PROJECTS HEAD LIST OF PRIORITIES

OW180548 Beijing XINHUA in English 0540 GMT 18 Jul 86

[Text] Beijing, 18 Jul (XINHUA)--China has expanded coal and crude oil production capacity by 4.41 and 4.86 million tons respectively during the first 6 months of 1986, according to the state statistical bureau today.

This year, China continues to give construction priority to projects involving energy and transportation.

Four out of 40 big and medium-sized power generating sets planned to be put into operation this year had gone to production by the end of June.

The four sets have a total generating capacity of 340,000 kilowatts.

Installation work has begun on the rest power generating sets.

Fifteen key coal mines tunnelled new pits totaling 91,000 meters during the same period.

Six key oil fields including Daqing, Shenli, and Zhongyuan had drilled wells totalling 5 million meters, half of the annual target.

The railway construction will give priority to the Datong-Qinhuangdao railway and double tracking project from Hengyang to Guangzhou.

Three 10,000-ton class berths at Ningbo port in Zhejiang Province has gone into operation.

The second phase project of the Baoshan iron and steel complex, including cold and hot rolling, is under construction.

/9604
CSO: 4010/69

NATIONAL POLICY

LI PENG STRESSES CONSTRUCTION OF RURAL ENERGY

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 16 Mar 86 p 3

[Article: "Li Peng Stresses Need To Focus on Good Work in Rural Energy Resource Construction--The Principles Are "Adaptation to Local Conditions, Mutual Supply With Surplus Energy, Comprehensive Utilization, Concern for Results"]

[Excerpt] CPC Central Committee Politburo member and State Council Vice Premier Li Peng pointed out that "work related to rural energy resources concerns the lives of China's 800 million peasants and the overall situation in agricultural production."

Li Peng discussed future rural energy construction and rural electrification work in China at the National Rural Energy Work Conference and the Full Session of the National Conference of the 100 Pilot Project Rural Electrification Counties on 14 March [in Beijing].

In a discussion of the guiding ideology of rural energy resource work, Li Peng stated that the overall guiding ideology of rural energy work for some time to come is continued adherence to the rural energy development principles of "adaptation to local conditions, mutual supply with surplus energy, comprehensive utilization, concern for results." He called for action to develop fuel forests, popularization of wood and coal-saving stoves, gradual development of methane, development of small-scale hydropower and small coal mines in areas with the proper conditions, establishment of test points for development and utilization of wind energy, solar energy and geothermal energy and efforts to do good energy conservation work.

He laid special emphasis on the fact that China's vast rural areas have an energy resource shortage as well as the reality of relative backwardness in energy utilization, low management levels and substantial waste. This situation requires special attention to raising the utilization efficiency of energy resources. For a rather long time to come, household electricity use in most rural areas will be dominated by firewood, straw, and other plant fuels. Coal supplies have increased in some areas, but demand cannot be met in most regions. For this reason, we must continue to strive in the future to popularize wood and coal-saving stoves and make additional improvements in the results of energy conservation.

Li Peng said that methane construction has entered the stage of healthy development and that methane utilization is developing from individuals to collectives, from small scale to medium scale and from single-purpose utilization to comprehensive utilization. Ever-greater economic, social and environmental results are being achieved. We should continue to work hard in this direction.

Li Peng discussed the question of trial rural electrification work in 100 counties across China. He said that we first of all selected mountainous regions with rather abundant hydropower resources, old [revolutionary base area] regions and minority nationality regions for the development of hydropower and thereby took the first step toward rural electrification. This can promote the development of rural electrification throughout China. Li Peng next discussed several principles and policies of work related to the development of small-scale hydropower. One aspect is active development of small-scale hydropower to achieve rural electrification. We should encourage reliance on our own efforts and depend mainly on local areas and the masses to raise capital to develop power, with state assistance where appropriate. Second, "using electricity to develop electricity" is a basic state principle related to small-scale hydropower. Local conditions can serve as the basis for rational readjustments in electricity prices to raise capital for "using electricity to develop electricity." Prices must be rational, however, to prevent the phenomenon of "arbitrary price increases and fee collection." Third, he advocated that with the exception of construction of certain key projects, all local areas should adapt to local conditions and act according to their capabilities to make it easy for capital to produce results as quickly as possible. Fourth, besides new construction projects, old projects that already have been built should focus on exploitation of potential while assuring safe production. Fifth, we should facilitate the connection of small-scale hydropower with large power grids. Sixth, we should take the seasonal quality of small-scale hydropower loads into consideration and adopt the method of mutual supply with surplus energy to improve the economic efficiency of small-scale hydropower. Seventh, in construction of rural energy resources, we should adapt to local conditions to make full use of local energy resources for the development of small-scale thermal power as appropriate. Areas that are far from power grids and that have wind power or geothermal power also should develop them as appropriate.

When discussing the establishment of a rural energy industry, assurance of the smooth implementation of rural energy resource construction requires that this question be treated as the order of the day. Examples include the manufacture and repair of solar cookers, methane, wind-powered generators, solar water heaters, wood and coal-saving stoves and other equipment. Machine manufacturing departments should improve the quality of their products and lower product costs, and they should provide a full complement of low cost quality products for rural energy resources and establish a repair network for the convenience of the users.

Finally, Li Peng said that science and technology should serve rural energy resource work. This is especially true of the need to work on rural energy at the present time. In addition, we also should do good training work for China's rural energy resource personnel and improve the technical quality of rural energy resource staffs.

Li Peng issued certificates on 14 March to Guangze, Wenzhou, Rongjing, Renhua, and Longmen counties for their achievements in elementary rural electrification. The National Work Conference of the 100 Pilot Project Rural Electrification Counties also closed on 14 March.

12539/5915
CSO: 4013/109

NEW TECHNOLOGY

PRESSURIZED COMBUSTION TEST OF COAL-WATER MIXTURE AS GAS TURBINE FUEL DETAILED

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 7, No 2, May 86 pp 162-165

[Article by Gao Lijun [7559 7787 0689], Institute of Engineering Thermophysics, Chinese Academy of Sciences: "A Pressurized Combustion Test of Coal-Water Mixtures as a Fuel in Gas Turbine Combustor"; this paper was read at the Fifth Scientific Annual Meeting of the Chinese Engineering Physics Society held in Suzhou in 1985]

[Text] English Abstract: The purpose of this paper is to examine the feasibility of Ultra-Cleaned Coal-Water Mixture (UCCWM) as a fuel in a gas turbine combustor. Five kinds of UCCWM were used in pressurized combustion at $4x10^5$ Pa, $7x10^5$ Pa, and $11x10^5$ Pa. The effect of combustor pressure on combustion efficiency, distribution of temperature, particle size, ash deposition, and gas exhaust was discussed. A viability of using CWM in modified aero-engines is being evaluated under atmospheric pressure.

This paper treats the feasibility of using ultra-cleaned coal-water mixture in gas turbine combustors. The cleaning process of ultra-cleaned coal-water mixture should be higher than in boilers, the average dimensions of the particle bodies in the mixture is on the order of 10 μm, ash and sulphur content is about 1 percent (by weight). This paper analyzes the pressurized combustion of five different ultra-cleaned coal-water mixtures at $4x10^5$ Pa, $7x10^5$ Pa, and $11x10^5$ Pa and emphasizes a discussion of the influence of pressure on combustion efficiency, wall temperature distribution, dimensions of particles in the exhaust gas, ash deposition, and gas exhaust, and describes the constant pressure combustion experiments using coal-water mixture made by Shandong's Datong Coal.

I. Important Constituents and Characteristics of Ultra-Cleaned Coal-Water Mixture

Table 1. Constituents of Ultra-Cleaned Coal-Water Mixture

Mixture number	Elemental analysis (% by weight) Carbon	Hydrogen	Oxygen	Nitrogen	Acid	Ash	Water (% by weight)	Appx. analysis (% by weight) Volatile matter	Fixed carbon	Ash
S1	76.45	4.73	12.97	1.84	1.00	3.01	36.18	36.53	60.46	3.01
S2	77.61	4.91	13.35	2.19	1.26	0.68	39.01	36.75	62.57	0.68
S3	78.56	4.95	11.62	1.55	1.12	2.20	41.40	37.53	60.27	2.20
S4	82.44	5.12	8.53	1.62	0.91	1.38	37.96	--	--	--
S5	82.44	5.28	7.74	1.86	1.0	1.13	35.51	--	--	--

Table 2. Characteristics of Ultra-Cleaned Coal-Water Mixture

Mixture number	Viscidity (cp)	Shear rate (s^{-1})	Maximum particle diameter (μm)	Average dia. of particle (μm)	Thermal value of coal (J/kg)
S1	889	2.5	40.3	5.27	31×10^6
S2	3,340	1.5	32	7.11	31.62×10^6
S3	331	2.5	40.32	6.12	31.8×10^6
S4	--	--	--		--
S5	--	--	--		34.33×10^6

II. The Pressure Combustion Test System

1. Shipping the mixture: Before feeding, the mixture flowed by gravity from the storage tank to the pump and the pump also constantly forced the mixture into the storage tank so that it constantly circulated to obtain a good flow of the mixture. The volume of mixture flow was regulated by regulating the air pressure entering the tank. 2. Atomizer: An anti-equilibrium twin channel pneumatic nebulizer was used in the test for the atomizer. See Figure 1 for a diagram of the structure of the nozzle head. Air is the atomizing medium. To avoid blocking of the mixture, a straight mixture channel is placed in the center of the nozzle. The natural gas channel is for preheating the combustor. The rotational direction of the atomizing air is the reverse of the mixture flow rate. 3. Cyclone: In the tests we used a slider cyclone to provide primary swirling air. Primary air flowing from the adjustable channel accompanied by secondary swirling air in the

reverse direction intensified the mixture of air and mixture in the combustor and formed a violent backflow area which promoted the combustion process. The maximum vortex number corresponding to when the maximum adjustment angle is 15° is 1.37. The air was preheated to 250°C-350°C. Preheating the air promotes evaporation of the water in the coal-water mixture and thus promotes ignition and a stable flame. 4. Combustor: The combustor with refractory cement lined walls is illustrated in Figure 2. It is made up of a central cylinder with a high speed area. An electrospark ignition fires the natural gas and when the walls are preheated to 1000°C, the burning natural gas is replaced by burning coal-water mixture. The smoke goes through a high temperature control valve and a water-quenching ring then is released into the atmosphere by an exhaust fan. The exhaust temperature dropped to about 150°C. The combustor pressure relies on guarantees of inputting an air and coal mixture at a definite pressure and regulating the high temperature control valve of the exhaust system is the way in which stability of pressure is achieved. 5. Measurement system: A thermocouple was used to measure the combustor wall temperature. Combustion efficiency was determined by measuring the CO_2 and O_2 in the combustion product. A quench sampling tube was used to collect smoke and a counter was used to determine the dimensions of the particles in the smoke.

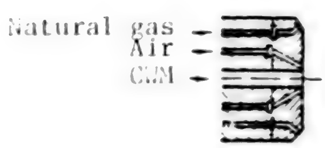

Figure 1. Atomizer Throat

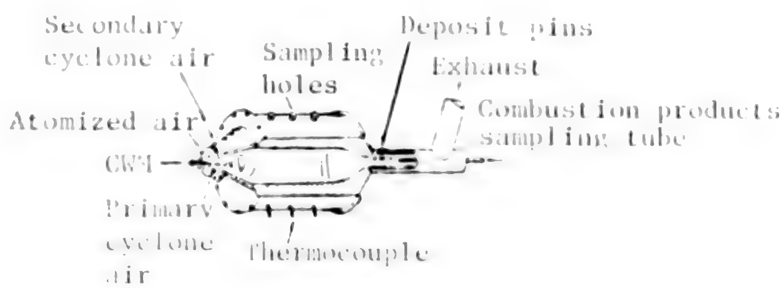

Figure 2. Combustor

III. Main Test Results

The tests were carried out on the basis of a series of selected parameter tests. Test parameters chosen through analysis and comparison are as follows: coal mixture flow was 45 kg/h, the excess air coefficient was 25 percent, the mass/flow ratio of atomized air to coal mixture was 3, the primary air cyclone number was 1.37, the flow distribution ratio of primary cyclone air to secondary cyclone air was 1:1. The main test results are as follows:

1. Combustion efficiency: Generally speaking, when fuel at a definite mass flow and air at a definite mass flow is supplied at different pressures in a gas turbine combustor, the temperature in the combustor does not basically change, thus it is held that the mass flow rate of air is directly proportional to pressure, therefore when the pressure is high there should be a high flame density and combustion rate, and when the pressure is high the flame temperature should be higher than when the pressure is low.

After the fuel is ignited a high radiation temperature is created, therefore the particle surface also should have a high temperature, and generally speaking, combustion efficiency at high pressure is higher than at low pressure. But on the other hand as pressure increases, the convection heat transfer of the particle surface to the surrounding air also increases[2], thus making the temperature of the particle surface lower, leading to a lowering of combustion as a whole. For burning the coal-water mixture, as pressure increases, reciprocal jietuan [4814 0957 aggregating?] of the particles is created thus reducing the overall combustion area which can also lead to lowering total combustion. The combustion efficiencies given in Figure 3 are average values. From the figure it can be seen that as pressure increases, the combustion efficiency is lowered, and when burning S4 mixture, the lowering of efficiency is most obvious. 2. Particles in the gas: Figure 4 gives the average diameter of the particle bodies in the smoke of different types of ultra-cleaned coal-water mixture at different pressures. The sampling tubes at positions #1, #2, and #3A(#3B) were located 13 cm, 33 cm and 53 cm, respectively from the combustion head flange surface. From the figure it can be seen that the diameter of most of the particles is between 10 μm and 20 μm and this value is larger than the diameter of the particles in the coal-water mixture. This is different from the situation of using constant pressure combustion of the same nozzle. At constant pressure, after the ultra-cleaned coal-water mixture has burned, the average diameter of the particles in the smoke is only one-half the average diameter of the particles in the coal mixture[3], so it can be seen from this that as the combustor pressure increases, the small particles jietuan together. From Figure 4 it can also be seen that as the coal-water mixture viscidity increases, the particle dimensions also increased, for example, the particle diameters of mixtures S2 and S5 which had a viscidity of about 3000CP were larger than S4 which had a viscidity of 331CP. From the figure it can be seen that at different sampling positions the changes in particle dimensions were not uniform either, not only because of the pulsation of combustion, but also due to sampling chance rate, and although during the tests there were sampling tubes at different cross-sections, a single point sampling tube can only obtain a sample at one (or two) point(s) on each surface. 3. Temperature: Figure 5 shows that when burning different types of ultra-cleaned coal-water mixture, the combustor exit wall temperature reached over 1180°C. The rise in temperature again at the 7th point in the figure indicates that when burning the coal-water mixture the flame is elongated. Therefore, when designing the combustor, sufficient combustor length and displacement and good air flow should be considered to achieve even higher complete combustion and combustor exit temperatures. 4. Discharge of combustion products: Figure 6 shows that in the combustion product the range of SO_2 was 450-570 ppm, the range of NO_x was 330-720 ppm. These values do not yet reach the U.S. national discharge standard. 5. Ash: The overall ash content in the combustor was low. For example, when burning S2 at 4.2×10^5 Pa, the total amount of mixture fed was 86 kg, and after the test, 325 mg of ash were collected in the combustor, only 0.38 percent of the amount of mixture fed, therefore most of the ash was expelled with the smoke.

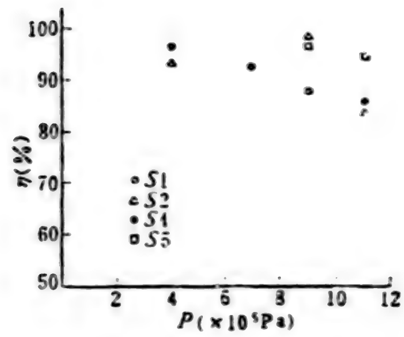

Figure 3. Combustor Efficiency

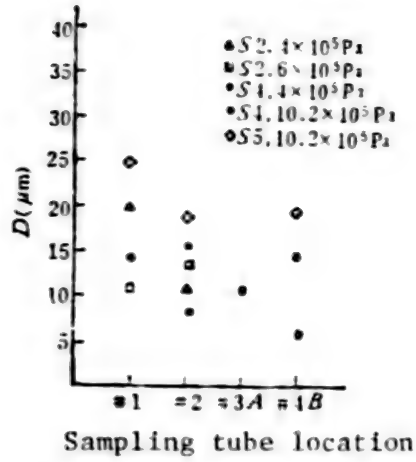

Figure 4. Average Diameter of Particle Bodies

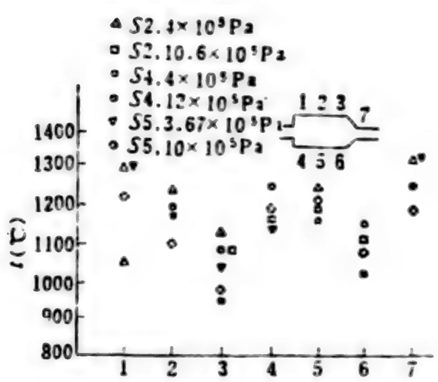

Figure 5. Wall Temperature

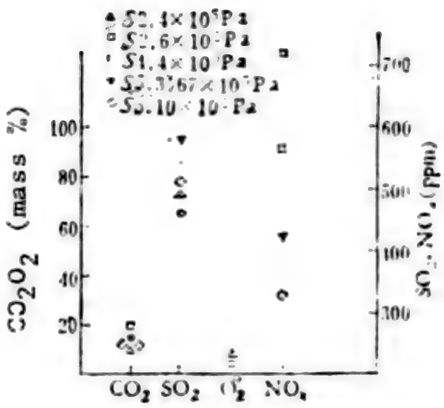

Figure 6. Composition of Combustion Products

IV. Constant Pressure Combustion Tests Carried Out in China*

We first carried out constant pressure combustion tests of the application of coal-water mixture to gas turbines in China in 1984. The combustor was an improved WP-5 aero-engine combustor and a pneumatic nebulizer nozzle was used to replace the original pressure centrifugal nozzle; taking into account that the spray distance of burning the coal-water mixture was longer, the four exhaust holes in the front of the flame tube were sealed; to increase the radiation of the flame tube inner walls, they were sprayed with Al_2O_3. See Table 3 for the parameters used in the test. The test showed that when there was a small amount of auxiliary ignition methane flame present,

*This work was carried out by the Application of Coal-Water Mixture to Gas Turbine Research Group of the Engineering Thermophysics Institute

the coal-water mixture could form torch stable combustion inside an improved aircraft gas turbine combustor. If we used oxygen as the injected gas in the nozzle, after the auxiliary ignition methane was cut off, a single coal-water mixture torch could maintain stable combustion. When the swirler was improved from the viewpoint of turbulence theory, we could see that the length in the flame area was clearly reduced, combustion intensity was increased, and at this time after the auxiliary ignition methane gas was cut off, the injection gas in the nozzle was switched from oxygen to air, and stable combustion by the single coal-water mixture torch was achieved in 16 minutes.

Table 3. Constant Pressure Combustion Test Parameters

Coal-water mixture flow	20 kg/h
Cold air flow	0.048 kg/s
Combustor inlet air temperature	873°C
Injected air flow	0.0017 m^3/s
Injection methane gas flow	0.00034 m^3/s
Supplemental air flow	0.0024 m^3/s

V. Conclusion

1. In the pressure combustion test bed with a heat tolerant layer adapter, when the nominal input heat was 0.737×10^9 J/h, the pressure combustion tests showed that the use of ultra-cleaned coal-water mixture in gas turbine combustors is feasible. When the coal-water mixture is burned below 12×10^5 Pa (meter pressure), most of the efficiency is above 90 percent. 2. When the excess air coefficient in the combustor is 1.2-1.4, the combustor outlet wall temperature reached more than 1180°C. 3. For the anti-equilibrium pneumatic nebulizer nozzle, when the atomized air ratio to coal mixture flow is 3, the pressure combustion tests indicated that the average diameter of the particle bodies in the smoke was between 10 μm and 20 μm, which value is larger than the diameter of the particles in the coal mixture. This indicates that at high pressure the particles jietuan together. 4. Although fairly stable combustion was achieved in the pressure combustion test bed, the discharge of SO_2 and NO_x is not up to U.S. national standards.
5. Exploratory constant pressure tests of burning coal-water mixture carried out in China in light structure improved gas turbine aero-engine combustors similarly proved the feasibility of burning coal-water mixture in gas turbines.

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SHANXI-BEIJING 500KV TRANMISSION PROJECT DETAILED

Beijing DILI ZHISHI [GEOGRAPHICAL KNOWLEDGE] in Chinese No 5, 7 May 86 p 7

[Article by Zhang Xuanyi [1728 1357 5030]: "On the Shanxi-Beijing's Datong-Fangshan 500KV Transmission Project"]

[Excerpts] The Shanxi-Beijing 500KV ultra-high voltage transmission key construction project, the first of its kind in China, has been completed. One line, carrying 220KV, was put into operation in June 1984, and the other line was completed in September 1985. The Datong-Fangshan 500KV transmission project has been formally put into operation and can transmit 1.6-2.0 million kilowatts to Beijing, Tianjin, and Tangshang, increasing the electric power capability of these areas by about 35 percent. This is equivalent to shipping 20,000 tons of standard coal a day to Beijing.

This project begins in the southern suburbs of Datong at the Datong No 2 Power Plant, and with a distance between the two lines no smaller than 70 meters, proceeds from west to east in parallel. After going only 2 kilometers, the path is blocked by the north-south Yu He, where technicians and workers courageously shouldered a heavy burden and through a combination of research and practice sunk into the riverbed 10 piles of high quality poured concrete which were 1 meter in diameter, 28.5 meters deep and capable of withstanding a force 12 wind, built a support and constructed a steel pylon. The line moved forward again.

The transmission lines continue along the valley, gradually climbing one of the Five Famous Mountains, the northern mountain, Hengshan. This place is 1,814 meters above sea level, the mountain is high, the wind is strong and the climate cold. Ascending from Nanxubao at 930 meters to Huoshiling at 1,744 meters is only 5,013 meters in a straight line, but the relative difference in altitude is 814 meters. Huoshiling is high and lacks water, so they used the advanced technique of protecting the pylon foundations with plastic film, thus ensuring the quality and progress of the project.

The line next goes through Guangling and Guoweixian, cutting across the majestic Taihang Shan, entering the middle section of the transmission project, the steep walls and cliffs of Taihang Shan. In many sections there were no

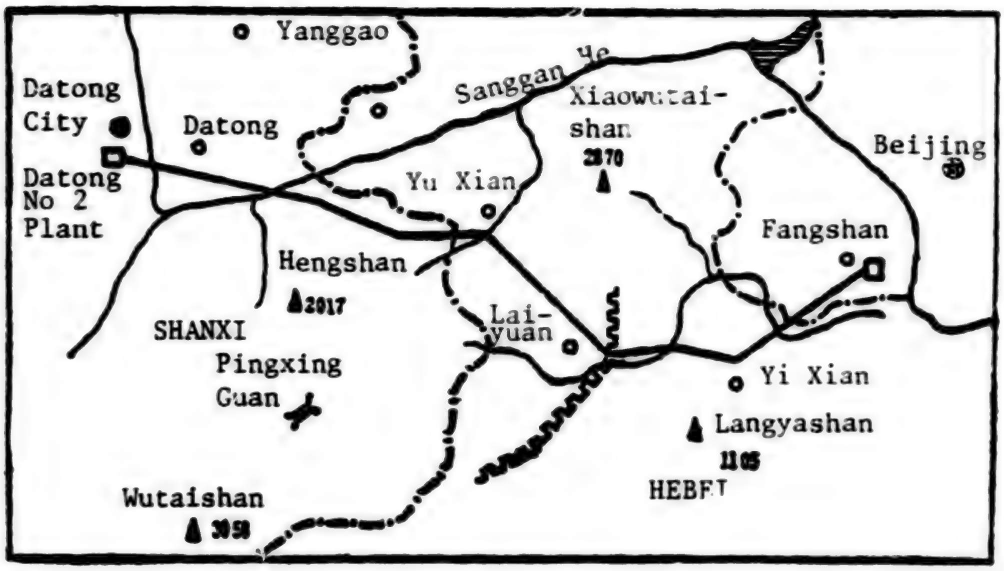
roads, some areas were desolate and uninhabited. There was no water source, mountains and hills make up 72.6 percent of the terrain, and in June in the middle of summer there is snow on the mountain tops and in early September in early autumn there is freezing. The lowest temperature was -40°C, the maximum wind was force 10-11. It was the most difficult section of the project for living, transportation, and construction of the entire 500KV ultrahigh voltage transmission project. State increases in expenses, the importation of new equipment, the improvement by project technicians of construction techniques and pooling the wisdom and efforts of everyone ensured the quality and completion of this formidable section of the project.

At Laiyuan and Zijingguan, the ancient battlefield prospect opens before us. Zijinguang is one of China's five major passes. Here, with the joint support of the Ministry of Aeronautics, navy airmen and the Ministry of Water Resources and Electric Power, we tested and used French super Frelon turbine engine long-range helicopters used at sea and on land to transport pylon materials, reels of cable, to lay and patrol the line, and transport personnel, greatly accelerating the progress of the project and also improving its quality.

The transmission project's western section crossed the Sanggan He, the eastern section crosses the Juma He four times, and broke through three engineering obstacles at Liangcaogou, Shijiagou, and Jiapigou, and in the Beijing suburbs overcame a heavily built-up area and the difficult problems of numerous corner pylons and difficulties in stringing line. It then enters Fangshan on the banks of the Dashi He in Beijing, the eastern terminus of the 500KV line.

The Datong-Fangshan transmission project cut across the two provinces of Shanxi and Hebei and the municipality of Beijing and spanned the peaks and high mountains of the Taihang Shan. Both lines are of overall lengths of 286 km and 288 km, respectively, with Datong No 2 Plant at the starting point of the 500KV booster station and Fangshan 500KV transformer station in Beijing as the terminus. The statistics for just one line follow: Overall, the line used 743 pylons and nearly 120,000 tons of steel; over 360,000 m^3 of earth and rock were excavated, and transport mileage exceeded 9.3 million km, equivalent to more than 233 times around the earth. The 500KV ultrahigh voltage transmission line is exposed to the elements and the maximum height from the ground of the lines is over 50 meters.

Putting the Datong-Fangshan 500KV transmission project into operation alleviates the serious shortage of electricity in the Beijing-Tianjin region. At the same time it reduces the pressure to ship Shanxi coal out and has important significance for promoting national economic development and meeting the needs of domestic life.



Map of Datong-Beijing Two Ultrahigh Voltage 500KV Transmission Lines

8226/8309
CSO: 4013/142

HUNAN ACCELERATES CONSTRUCTION OF KEY POWER PROJECTS

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 4 Apr 86 p 3

[Article: "Hunan Accelerates Construction of Key Power Projects--120,000 kW in Generating Capacity Is To Be Added"]

[Text] Hunan Province has accelerated the construction of key power projects and achieved excellent results.

In 1985, all of the five key power construction projects underway in Hunan Province completed investment plans in excess of quotas and added 120,000 kW in generating capacity. Construction tasks at the large dam at the Dong Jiang hydropower station, one of China's key projects, exceeded the original plan by 18 percent and were 15.8 percent greater during the first 2 months of 1986 compared with the same period in 1985. The dam now has reached a height of 224.8 meters and preparations to close the gates and begin accumulating water now are underway. Efforts are being made to have the first generator begin producing power ahead of schedule. The 500 kV high-voltage power transmission line project from Gezhouba to Changde will involve 249 steel towers inside Hunan Province, and completion of all of them is expected in May.

There has been a rather serious power shortage in Hunan Province in recent years. Besides striving to develop small-scale hydropower to alleviate this shortage, the relevant state departments also have provided assistance for construction of several key power projects. To accelerate construction at key projects, the Hunan Provincial CPC Committee and Provincial Government adopted measures beginning in 1985 to achieve a true strengthening of leadership. The main responsible comrades made several intensive on-site visits and aided in solving real problems that appeared during construction. The Leiyang power plant needed to build an ash dumping ground, but a failure to arrange the land caused construction delays. In December 1985, Hunan Provincial CPC Secretary Mao Zhiyong [3029 5268 3938] and Hunan Provincial Governor Xiong Qingquan [3574 3237 3123] went to investigate the work site and discovered this situation. They called on the [Leiyang] County CPC Committee to do good work and deal with it as soon as possible. Land arrangements were completed by January 1986.

All areas and departments in Hunan Province have cooperated in providing financial, material and manpower assistance to the construction of key projects. The Hunan Province Metallic Materials Department opened up its warehouses and gave preferential supplies of different types of steel to meet the needs of the key projects.

12539/5915
CSO: 4013/109

35 MILLION KW IN POWER EQUIPMENT TO BE PRODUCED IN 7TH FYP

Beijing ZHONGGUO JIXIE BAO in Chinese 3 Jul 86 p 1

[Summary] During the Seventh Five-Year Plan, the electrical engineering industry will focus on the development of power generating equipment, and during those 5 years will produce electric power generating equipment with an installed capacity of 35 million kW. The amount produced in 1990 will total 8 million kW, of which 6.8 million kW will be thermal power generating equipment and 1.2 million kW will be hydropower generating equipment.

China will work to develop large, energy-effecient, and reliable thermal power generators. Also, boilers that burn coal with a low calorific value to produce both heat and power and that adjust for peak loads will be developed. More than 90 percent of the three main components and auxiliary machinery for the 300,000 kW and 600,000 kW generators that we import will be domestically produced. Electrical equipment must be developed for different types of generators with different water heads and different capacities for hydropower equipment. Early on we must engage in scientific research work for the massive Three Gorges generators. Small hydropower generators must be developed in a standardized and planned fashion and be largely automated. In addition, by the end of the Seventh Five-Year Plan, conventional generators for 600,000 kW nuclear power equipment will be designed.

While developing power generating equipment during the Seventh Five-Year plan, the industry will also try to develop the capability to produce complete equipment for 330 kV and 500 kV transmission lines and transformer stations. By 1990, 60 percent of the capacity of industrial boilers must have a heat efficiency rating higher than 70 percent. We will develop basic electrical components and basic materials, and the existing 380 sets in low-voltage electrical equipment will be replaced by 125 new sets (basic systems). We will strive to develop new insulating materials and increase the proportion of heat resistant insulating materials. We will work hard to expand exports of electrical engineering products and in 1990 should earn more than double the amount of foreign exchange earned from exports in 1985.

In order to guarantee the implementation of the Seventh Five-Year Plan, the electrical engineering industry will work hard to improve product quality, and by 1990 the quality of more than 50 percent of key products should attain the levels of advanced industrial nations in the late 1970's and early 1980's.

CSO: 4013/156

POWER NETWORK

BRIEFS

SEMI-ANNUAL OUTPUT FIGURES RELEASED--Beijing, 22 Jul 86, (XINHUA)-- The 5 million kilowatts in installed capacity that came on stream in the country in 1985 has shown obvious economic benifit in the first 6 months of 1986. According to statistics, in the first half of the year, China generated 215.08 billion kilowatt-hours of electricity, an increase of 8 percent over the same period of 1985. Of the more than 15.9 billion kilowatt-hours of added output, some 11.9 billion kWh, or three-fourths, came from the large and medium generator sets installed in 1985. [Excerpt] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 23 Jul 86 p 3]

SICHUAN POWER CONSTRUCTION--To improve energy resources for industrial production, the Sichuan provincial people's government has stepped up electric power construction. This year, electric power of some 500,000 kW will be put into operation, of which 400,000 kW will be provided by the Southwest Electricity Management Bureau of the Ministry of Water Resources and Electric Power, and 80,000-100,000 kW by the provincial Water Conservancy and Power Department. The Southwest Electricity Management Bureau, provincial Water Conservancy and Power Department, all cities and prefectures, and factories, mines, and enterprises concerned are concentrating their forces to step up construction to ensure that their projects will be put into operation on schedule. After electric power of 500,000 kW is put into operation, the acute power shortage in Chongqing, Chengdu, and the southern part of Sichuan can be eased to a certain extent. /Summary/ /Chengdu Sichuan Provincial Service in Mandarin 0930 GMT 10 Jul 86 HK/ 12228

ZHEJIANG TO DOUBLE OUTPUT--Hangzhou, 5 May (XINHUA)--Zhejiang authorities plan to add 2 million kilowatts to the province's electricity generating capacity over the next 5 years, said an official in this provincial capital. This would be double the capacity installed over the past 5 years. New transformers will also be installed over the next 5 years, along with 1,347 kilometers of 220 kV transmission lines and 507 kilometers of 500 kV transmission lines. The plans will be funded by the government, foreign loans and money raised by local authorities, the official said. Electricity charges for industry will be raised to help pay for the development. [Text] [Beijing XINHUA in English 1502 GMT 5 May 86 OW] /12624

CSO: 4010/68

PROPOSAL TO STEP UP TEMPO OF HYDROPOWER CONSTRUCTION DETAILED

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 4, 12 Apr 86 pp 6-8

[Article: "Proposal To Speed Up Hydropower Development Presented at Second National Congress of Chinese Society of Hydroelectric Engineering"]

[Text] In November 1985 the Chinese Society of Hydroelectric Engineering convened its second national congress. The 276 specialists, professors, scientists and techicians in hydroelectric power freely discussed China's present favorable situation, achievements in hydropower construction and the bright prospects. However, they were very worried about the serious shortage of electricity in China today and the extremely small scale of hydropower construction, which will inevitably result in a greater shortage of electricity. Particularly with hydropower, we will bungle the opportunity if we do not stress making a determination to expand the scale of construction in the Seventh Five-Year Plan.

The several schemes forecasting "China's energy resources in the year 2000" in the series of study reports, including "China in the Year 2000," conducted by the State Council's Technical and Economic Research Center all expound on the supply and demand of energy in China in the year 2000 clearly show that there will be a shortage--"the median value will be 220 to 260 million tons of standard coal, which will be a shortage of about 15 to 20 percent and will be higher than the shortage at present." In its proposal on the strategy and policy of energy development, the report points out that "Improving the primary energy structure is highly significant to improving social and economic results. The chief measures include speeding up the development of hydropower, nuclear power and natural gas, and making appropriate reduction in the proportion of coal. China is rich in hydropower resources and speeding up hydropower construction is the most realistic way to improve the energy structure."

The blue book of "China's technical policy" drawn up by the State Science and Technology Commission stresses in its main points of the energy and technical policy: "Hydropower is a renewable primary source of energy and we must implement the guiding principle of giving priority to the development of hydroenergy." "Active development of hydropower is the most realistic way to improve the primary energy structure. China's potential of exploitable hydraulic resources is very high. In terms of such conditions as preconstruction work, design, construction, and equipment manufacturing, it is possible to improve the proportion of hydropower in the primary sources of energy.

We should be determined to continue developing hydropower." "Build a rational energy structure and increase the proportion of hydropower."

Last year, the Chinese Society of Hydroelectric Engineering advanced the goal of "quadrupling hydropower to 80 million kW by the year 2000," maintaining an overall pattern of synchronous development with the electric power industry, that is, maintaining the relatively low ratios of around 30 percent in installed capacity of hydropower and 20 percent in power output, but before increasing the proportion of hydropower. We should and we can possibly achieve this goal, and it is best if we can surpass it.

Because few large and medium-sized hydropower stations began construction in the 1970's, few of them can be put into production in the 1980's. From 1981 to 1985, only about 6 million kW in installed capacity was completed (of which large and medium-sized stations made up 3.27 million kW and small stations 2.53 kW), and it is expected that between 1986 and 1990 about 10 million kW can be completed (of which large and medium-sized stations will make up 8 million kW and small stations 2 million kW). In this way, the estimated total that can be completed in the first 10 years will be only about 16 million kW, or less than double (to double on the basis of 20 million kW in 1980 we need to increase capacity by 20 million kW). Therefore, the task for the next 10 years will become even more burdensome, and inevitably we need to do better than doubling. But whether we can achieve faster development in hydropower in the 1990's is determined by the number of hydropower projects that can be newly constructed in the 1980's. Because of excessive reduction in investment in hydropower in the Sixth Five-Year Plan in the readjustment of the capital construction plan, newly constructed hydropower stations are too few, with only about 5 million kW, making it urgent that we compensate for this in the Seventh Five-Year Plan. According to this, we should expand the scale of projects under construction in the Seventh Five-Year Plan and be determined to include a group of large hydropower stations, and actively develop medium-sized and small hydropower stations. It will then be possible to realize the goal of 80 million kW by the year 2000. If we cannot list additional projects in the Seventh Five-Year Plan but delay their construction until the Eighth Five-Year Plan, then some of the large hydropower stations will not be able to go into production and play their role prior to the year 2000.

According to our understanding, the Seventh Five-Year Plan which is being drawn up has initially arranged for only 4 large and medium-sized hydropower projects (Shuikou in Fujian, Manwan in Yunnan, Lijiaxia in Qinghai, and Yamzho Yumco in Xizang) with a total of 4.37 million kW, which is smaller than the scale of new construction in the Sixth Five-Year Plan. Based on this plan, not only will it be impossible to achieve the goal of 80 million kW by the year 2000, it may be hard to achieve even 60 million kW.

For China in the long run, on one hand the supply and shipping of coal will become very pressing and on the other hand we will have a great deal of renewable hydropower resources not being utilized. After 20 to 30 years of survey and study, preliminary designs or feasibility studies have been completed for a large group of hydropower stations and our construction forces are ready have not been inclucded in the plan. The delegates to the congress paid a

great deal of attention to this and were very concerned. In order to implement the Party Central Committee's and the State Council's guiding principle on active development of hydropower and to improve the primary energy structure, they unanimously proposed:

I. Expand the Scale of Hydropower Under Construction, Step Up the Pace of Hydropower Construction

1. The various engineering bureaus must actively strive to lower construction cost through economic restructuring and technological innovation. Strive to complete ahead of schedule the total of more than 11 million kW in installed capacity of the 24 hydropower projects now under construction (of which more than 8 million kW can be put into production during the Seventh Five-Year Plan period) so that they can give play to their benefits as soon as possible.

2. For the Seventh Five-Year Plan, besides the four projects which will definitely begin construction and the Three Gorges project which is under preparation for construction, construction of an additional 13 hydropower projects is proposed. They include 11 conventional hydropower stations of Wuqiangxi in Hunan, Geheyan in Hubei, Taipingyi, Ertan, and Pengshui in Sichuan, Shanxi and Tankeng in Zhejiang, Mianhuatan in Fujian, Tianshengqiao High Dam on the Guizhou-Guangxi border, Longtan in Guangxi, and Daxia on the Huang He, as well as the two pumped-storage power stations of Shisanling in north China and Tianhuangping in east China (see Table I). The 11 conventional hydropower stations mentioned above are all situated in areas that are abundant in water but short of coal and should logically be developed by suiting measures to local conditions while the two pumped-storage power stations which are in areas with low ratios of hydropower should provide the urgently needed peak regulation capacity. At present, preliminary design has been done for some of the projects and some have already completed feasibility study reports and are going through preliminary design. They are all hydropower stations that need to be constructed in the electric power development plans of their respective areas. These projects are indispensable to initiating new conditions for hydropower development and in easing the shortage of electric power, and we need to stress beginning construction ahead of schedule.

These 13 large hydropower stations have a total installed capacity of 16.5 million kW with an annual output of 61 billion kWh and at a total investment of approximately 20 billion yuan. Of the investment, 3.5 billion yuan are needed in the Seventh Five-Year Plan period which is equivalent to 1 percent of the 350 billion yuan in national total investment on capital construction in the Seventh Five-Year Plan. It is proposed that when making arrangements and plans, the state should put together the necessary financial and material resources and allocate a definite increase in investment on hydropower.

3. Besides making plans for the necessary large hydropower stations, the state can also give support to local authorities to build a group of medium-sized hydropower stations. They have the advantages of low investment, short construction time and quick results. At present, large hydropower stations are arranged by the state while small stations are built by local authorities themselves. Construction of medium-sized hydropower stations with a capacity

above 12,000 kW and under 100,000 kW has not aroused attention. Some provincial and regional delegates proposed that if the state gives interest-free loans of 500 yuan per kilowatt for medium-sized hydropower stations and the rest of the fund is locally raised, then after construction is completed they can carry out the policy of self-construction, self-management and self-use just like small hydropower stations, and in this way there will be local enthusiasm. In the next 15 years, it is possible to begin construction of a group of medium-sized hydropower stations with a total capacity approaching 10 million kW. It is proposed that the state provides an average annual loan of 300 million yuan, which can yield very good results and compensate for the slump in the increase of hydropower capacity and production during the Seventh Five-Year Plan and Eighth Five-Year Plan which is about to take shape. This is both a fast and economical way.

Small hydropower stations geared to the countryside should also continue to be developed. So far, China's small hydropower stations already have an accumulated installed capacity of 9 million kW. One hundred rural electrification experiments [pilot] counties nationwide are being developed and it is expected that in the next 15 years another 10 million kW will be developed, which is also possible.

II. In Order To Promote Active Development of Hydropower, a Set of Preferential Policies Is Proposed

1. Lower the interest rate of loans, extend the repayment period. It is proposed that annual interest should not exceed 2.4 percent and that loan shoul be repaid within 25 years beginning from the year after the hydropower station is put into production.

2. Practice shared investment for comprehensive utilization. It is proposed to stipulate that for the electric power station, hydropower construction units are to be responsible for the loan, repayment and interest payments, and that investment on the portion on increasing water conservancy and navigation benefits should be funded by concerned departments.

3. In the light of the urban gas industry, implement energy conservancy subsidies for large and medium-sized hydropower stations. Give a one-time subsidy of 300 yuan for each ton of standard coal conserved (generated hydroelectric energy multiplied by the consumption of standard coal for thermal power of that year).

4. In selling electricity to power networks, hydropower stations must figure the rates according to peaks and valleys, high and low water periods, and set high prices for good quality.

5. The state should make a definite strategic investment to develop hydropower or agree to issue a definite number of hydropower development bonds. Encourage diverse forms of fund raising to run electricity and practice the principle of "self-constructon, self-management and self-use" in the light of the policy on small hydropower stations. At the same time, we must fully utilize foreign capital to develop hydropower, utilize low-interest foreign loans, and permit Sino-foreign joint ventures to run hydropower.

Table 1. Additional Hydropower Projects Proposed for Construction During the Seventh Five-Year Plan Period

Hydropower station	River	Installed capacity (10,000 kW)	Annual Output (100 million kWh)	Population Resettlement (10,000)	Total Investment (100 million yuan)	Construction time for power generation years	Remarks
Wuqiangxi	Yuan Shui	120	53.7	8.5	20.0	8	Solves the demand for electricity in Hunan which is short of coal and electricity; has comprehensive benefits of flood prevention and navigation
Geheyan	Qing Jiang	120	30.6	2.0	13.0	8	Coordinates with Bezhouba to tackle the task of peak modulation in Hubei; beneficial to flood prevention
Ertan	Yalong Jiang	300	165.0	2.0	36.0	10	Solves Sichuan's demand for electricity
Pengshui	Wu Jiang	120	61.0	1.7	14.8	9	Solves the demand for electricity in eastern Sichuan and Qiongqing areas
Taipingyi	Min Jiang	26	17.0	very few	4.3	5	Solves Sichuan's demand for electricity
Shanxi	Feiyun Jiang	(30) 24	4.1	2.9	4.5	5	Increases Zhejiang's sources of electricity
Tankeng	Ou Jiang	60	10.3	3.8	9.0	6	
Mianhuatan	Ting Jiang	60	14.0	4.0	7.0	5	Solves the demand for electricity in southern Fujian and Xiamen areas, can transmit power to Guangzhou
Tiansheng-qiao High Dam	Nanpang Jiang	120	53.0	2.5	20.8	9	Improves the power generating performance of the Tianshengqiao low dam, which together transmit power to Guangdong and Guangxi
Longtan	Hongshui He	500	187.0	6.4	48.0	10.5	A multiyear-regulated reservoir on the Hong-shui He and a key power station supplying electricity to Guangdong, Guangxi, Hong Kong and Macao; has comprehensive benefits of improving power generating performance of Yantan and Lahua as well as flood prevention, irrigation and shipping
Daxia	Huang He	30	15		4	6	Increases upper Huang He's sources of electricity
Shisanling	Pump-storage power station	72		--	8.1	6	Solves the pressing problem of peak modulation in the North China Power Grid
Tianhuang-ping	Pump-storage power station	120		--	11.1	7	Solves the pressing problem of peak modulation in the North China Power Grid
	TOTAL	1,652	610	33.8	220.5		

6. According to the delegates from Fujian, at present they can raise U.S.$[illegible] million from overseas Chinese and hope that the state banks will turn this foreign exchange into renminbi for local authorities to build hydropower stations. Local authorities will repay the state banks in renminbi which will return to foreign exchange. If this issue can be resolved, they can still continue to raise funds from overseas Chinese. In this way, an additional 1 million kW of hydropower can be set up in the single province of Fujian by the year 2000. This will be advantageous to both the state and local areas and it is hoped that state banks will cooperate. It is possible for provincial areas such as Fujian, Guangdong, and Guangxi to raise funds from overseas Chinese.

III. Speed Up the Progress of Structural Reform, Establish Regional Hydropower Development Corporations

It is proposed that regional hydropower development corporations be established in qualified regions, such as upper Huang He hydropower development corporation, Hongshui He hydropower development corporation, Wu Jiang hydropower development corporation, Lancang Jiang hydropower development corporations, and so forth. We can also establish corporations for various joint operations such as aluminum and electric power and phosphorus and electric power. Survey and design units must take on the character of enterprises, scientific research should practice a system of contracts, and construction should practice the contract system of bidding.

The delegates unanimously indicated that under the leadership of the Party Central Committee and the State Council, they must contribute all their knowledge and strength, vow to accelerate hydropower construction, and strive and struggle to realize the goal of achieving a total hydropower installed capacity of 80 million kW by the year 2000.

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CSO: 4013/131

VIEWS ON ACCELERATING HYDROPOWER DEVELOPMENT PRESENTED

Beijin SHUILI FADIAN [WATER POWER] in Chinese No 4, 12 Apr 86 pp 3-5

[Article by Li Rui [2621 6904]]

[Text] I was invited to attend the second congress of the Chinese Society of Hydroelectric Engineering held in Nanning from 7-16 November 1985. More than 200 specialists, professors, and cadres attended the congress. Everyone was disturbed by the present slow pace in hydropower development, particularly the number of projects in the Seventh Five-Year Plan are too few, which will have a serious impact on the electric power situation. As a source of reference for concerned quarters, I will put forward the following views on ways to accelerate hydropower construction based on my understanding of the circumstances.

1. The growth of hydropower is slowing steadily. According to the figures, the average annual growth rates of installed hydropower capacity nationwide are as follows: 21.5 percent in 1953-1957 (First Five-Year Plan); 18.5 percent in 1958-1962 (Second Five-Year Plan); 8.3 percent in 1963-1965 (3 years of readjustment); 15.6 percent in 1966-1970 (Third Five-Year Plan); 16.6 percent in 1971-1975 (Fourth Five-Year Plan); 8.6 percent in 1976-1980 (Fifth Five-Year Plan); and 6.0 percent in 1981-1985 (Sixth Five-Year Plan).

There has been a notable drop in the past 10 years due to the fact that the number of hydropower stations that began construction during the 10 years of turmoil was too few. China's water energy resources have unique advantages, and after more than 30 years of practice it is generally recognized that we should accelerate hydropower construction. When comrade Zhao Ziyang listened to the work report of the former State Energy Commission (where I was working at that time) in October 1980, he pointed out that "Hydropower differs from coal and petroleum. It is a renewable energy resource and not a one-time consumed energy. Moreover, it does not pollute and must be taken as a strategic measure. This requires strategic foresight. We cannot yield to present difficulties year after year and cause delay, and look back one day to realize that we had committed a major mistake." Comrade Hu Yaobang had dedicated these words to the Baishan hydropower station in 1984: "China's hydropower resources are the best in the world, the electric power industry takes the lead in the modernization drive." All this was very correctly said. In terms of the policy on electric power construction, it had been advanced long ago

that emphasis should be gradually placed on hydropower so that it could be developed quickly.

As we know, however, only 4 hydropower projects have been initially arranged for construction in the Seventh Five-Year Plan, namely Shuikou in Fujian, Manwan in Yunnan, Yamzho Yumco in Xizang and Lijiaxia in Qinghai (with a total of 4.37 million kW), and while the first three projects began last year Lijiaxia will actually be the only project newly constructed. Hydropower construction time is relatively long, and in order to increase the annual rate of growth there is the question of the scale of projects under construction (generally the ratio of the scale of projects under construction to the scale of projects that go into production in a given year should be 10:1). Hydropower projects under construction going from the Sixth Five-Year Plan to the Seventh Five-Year Plan amount to more than 11 million kW, of which 8 million kW are expected to be put into production in the Seventh Five-Year Plan. In this way, the amount from the Seventh Five-Year Plan to the Eighth Five-Year Plan will be less than 8 kW. Unable to make ends meet, the speed of hydropower development will slow down further, the proportion of hydropower in electric power will gradually decrease, which is extremely unfavorable to the overall electric power situation.

According to the recently published research report "China's Energy Resources in the Year 2000" (see JINGJI RIBAO [ECONOMIC DAILY], 9 Nov 1985), shortages will appear in several forecast plans, and intermediate plans will be short of 220 to 260 million tons of standard coal, which form 15 to 20 percent of the needed amount, more than the current shortage. That report said in its policy proposal: "China is abundant in water energy resources, accelerating hydropower construction is the most realistic way to improve the energy structure." This is also very correctly stated.

2. Concerning the electric power plan by the year 2000, logically its growth rate should be slightly higher than that of industrial and agricultural output value (in other words, the elasticity coefficient of electric power must be greater than 1). In other words, even if growth is synchronous, we must have 12 billion kWh by quadrupling the 3 billon kWh of electricity generated in 1980 and the corresponding installed capacity must be 250 million kW or more. On this assumption, several years ago the Ministry of Water Resources and Electric Power had proposed that it was necessary to increase the installed hydropower capacity from 20 million to 80 million kW by the year 2000 (other quarters even proposed that it should be increased to 90 or 100 million kW). If we consider on the basis of 80 million kW, then we should have expanded the scale of projects under construction beginning from the Sixth Five-Year Plan and once every 5 years we must generally begin the construction of large, medium-sized and small hydropower stations with a total capacity of approximately 20 million kW in order to meet this demand. However, the large and medium-sized hydropower stations that began construction in the Sixth Five-Year Plan total merely 5.5 million kW and at the end of 1985 the scale of hydropower under construction was merely 11.4 million kW, a mere increase of 1 million kW from the end of 1980. Reportedly the original plan was to increase it to 28 million kW. Naturally the excessive difference resulting from this has an enormous impact on hydropower projects going into production in later years. The inexpediency

of the Sixth Five-Year Plan is irredeemable. According to the current plan, hydropower capacity going into production in the Eighth Five-Year Plan cannot possibly exceed 5 million kW, which is far less than the 8 million kW in the Seventh Five-Year Plan. Such falling-off really should not recur again.

Therefore, regardless of the numerous problems we have to cope with in the current investment plan, we must increase the number of hydropower projects in Seventh Five-Year Plan by every possible means. Otherwise, not only will attaining 80 million kW be out of the question, perhaps even 60 million kW will be doubtful. In this way, by the year 2000, the proportion of hydropower in electric power will drop to 15-16 percent (currently 31 percent) excluding the capacity of small hydropower stations. The gravity of such results and the impact on power grid operation can only be profoundly understood by the power supply system.

We must not miss the opportunity that will not come again. It will be hard to make remedies if we do not expand the scale of hydropower construction in the Seventh Five-Year Plan but wait until the Eighth Five-Year Plan. Therefore, in every possible way we should include in the Seventh Five-Year Plan even more of the large and medium-sized hydropower projects which are qualified to begin construction. When the comrades from Guangxi talked about the necessity to speedily develop the entire river basin of the Hongshui He, they expressed the hope that we should not delay the marriages of the "second daughter" and "third daughter" (referring to Longtan and others) because the "eldest daughter" (the Three Gorges) has not been married off.

Three large hydropower projects that should be arranged in the Seventh Five-Year Plan are listed as follows:

(1) Wuqiangxi in Hunan (1.2 million kW, 5.4 billion kWh of electricity) is beneficial to flood prevention and navigation. A low-interest Japanese loan was obtained in 1980 and preparation for construction began long ago, but the project ran aground because of the problem of loss from inundation (resettlement of more than 100,000 people). After lowering the dam height, only 80,000 people are to be resettled, 40,000 mu of land inundated and Hunan has already undertaken all of the population resettlement cost. Reportedly the State Planning Commission has recently listed it as a reserve project; it should be listed as a regular project and construction should be resumed immediately.

(2) Ertan in Sichuan (3 million kW, 16.5 billion kWh of electricity) involves the resettlement of fewer than 20,000 people and everything is ready. Sichuan is willing to undertake part of the investment. This will be a key power station of the Sichuan (southwestern) power grid. Sichuan's hydropower resources rank first in the nation and the trunk rivers and tributaries of the Chang Jiang in Sichuan should be first developed as soon as possible (loss from inundation is small, and silt will be blocked, which is beneficial to the construction of Three Gorges).

(3) Longtan in Guangxi (5 million kW, 18.7 billion kWh of electricity) has a resettlement of only 60,000-odd people. After the large reservoir (capacity 27.3 billion cubic meters) regulates the flow of the Hongshui He, it can

thoroughly alter the passive situation of inadequate water for hydropower stations in Guangdong and Guangxi during the dry season and will become a key power station for supplying power to Guangxi, Guangdong, and Hong Kong, and its investment is less than the Shenzhen Nuclear Power Station (1.8 million kW, approximate cost U.S.$4 billion). Incidentally, after seeing the Hongshui He, an official from Tennessee in the U.S. found it strange that instead of promptly developing it we first undertake nuclear power in Guangdong.

Only three examples are listed above. Other such as Geheyan and Daxia are qualified to begin construction and should be included in the Seventh Five-Year Plan. There is a great deal of rich hydropower resources (the upper Huang He, the southwest, and Yunnan river systems), and medium-sized hydropower stations that can be constructed in east and northeast China total several million kW.

3. China has a shortage of 40 to 50 billion kWh of electricity for a long time which has seriously affected economic development and the lives of the people. If we calculate on the basis that each kilowatt-hour creates an industrial output value of 2.8 yuan, the loss in output value is around 130 billion yuan and generating 30 billion yuan less in taxes and profits. The basic cause of this situation which is hard to reverse still lies in inadequate construction fund and in the past we never had a proportional and truly advanced long-term electric power plan. It is a practice among countries in the world that investment on electric power industry is several times greater than other industries (such as machinery, petroleum and metallurgy); and it has been treated as non-profit public utilities (which can support its development on its own accumulation), consequently such a long-term power shortage has never occurred in Western countries, the USSR and Eastern Europe. In the past we have not understood the objective law that investment on electric power must be far greater than other heavy industries (the steel industry had enjoyed predominance, petroleum has so far been enjoying favoritism, but electricity has always trailed behind). As a result, on one hand investment on electric power has been inadequate and on the other hand profits and taxes from electric power has been used as principal fiscal revenues, using accumulation from electric power to support the development of power-consuming industries for a long period of time. Therefore, one is in shortage and the other is in surplus, and there are few suppliers of electricity to a large number of consumers. How could this not create a long-term shortage of electricity! Electricity is abundant in the market economy of capitalist countries; on the contrary it is in shortage in our planned economy and for decades we have not been able to reverse this situation (if we follow the old ways we will not be able to do so even in the 21st century), and the basic causes truly deserve to be studied seriously. On this question as well as on how we can put an end to the passive state of electric power through the economic structure, lowering taxes, changing electricity rates, and supporting electricity with electricity and having many sources of supply of electricity, we believe that comrades of electric power departments have substantial proofs and proposals and I am merely posing this question. We can do nothing about the past but we can catch up in the future; we should at least make some remedies (we dare not say reverse the situation) in the Seventh Five-Year Plan.

4. I have been in charge of hydropower construction for 11 years in the 1950's and again in the 1980's and I feel very strongly about the slow progress in China's hydropower development for a long period of time. As discussed above, funds in the past have been limited and the old ways to develop electric power take into consideration only what is immediate: installing plenty of thermal power generating units quickly in order to cope with the annual needs, and finding it hard even to consider whether they can be met by coal supply and shipping, for instance, 10 million kW in oil-burning generator units was developed very quickly in the 1970's. Because thermal power came quickly and allocation of coal became unified, present state plan and local enthusiasm still rest on thermal power (which is necessary): collective fund to run electricity, special fund to replace oil with coal, energy conservation investment, and the various favorable terms to the Huaneng Corporation can still only be given to thermal power. The so-called guiding principle that "emphasis must be shifted to hydropower in electric power construction" is nothing but empty talk. There have never been practicable concrete measures and even the state has never had any preferential policy toward hydropower. Hydropower is a regenerative source of energy which can save fuel and has comprehensive benefits. The cost of its generation is much lower than thermal power. It can be used for undertaking power grid load alternation (peak regulation, frequency modulation, and emergency backup). Capital construction investment differs little from thermal power (inclusive of investment on coal and shipping). Capital construction can be drawn on local resources and civil engineering makes up two-thirds of the investment (on the contrary, thermal power equipment makes up two-thirds of the investment). There is no problem of environmental pollution (to solv the pollution of thermal power, investment must be increased by one third). Moreover, tourism can be developed; and large hydropower stations give impetus to the development of new economic areas. Not only do we lack sufficient understanding of these favorable conditions of hydropower but we have over-criticized hydropower (for instance, the problem of low-flow periods; excessively long construction time is the result of many causes, construction time was very short in the 1950's). Hydropower development in developed countries is more or less complete; in developing countries such as India and particularly Brazil it is faster or much faster than China. Already we have plentiful strength in hydropower construction and rich experience, particularly we have batches of "rich ore" projects waiting to start construction, but the key to the question is that there is no preferential policy for hydropower development. For example, in projects of comprehensive utilization, investment is not shared but entirely undertaken by hydropower. When Japan makes loans to China for hydropower projects, repayment is long-term and the interest rate is low (the World Bank also has preferential terms for hydropower development); whereas in China, bank loans for either hydropower or thermal power are all repaid in 15 years and the interest rate is the same (now someone even uses this unreasonable loan method to make isolated comparison of investment on hydropower and thermal power in order to play down hydropower). Within electric power departments, basic depreciation and major repair depreciation of hydropower have also been eaten up by the "big pot". Reportedly, in order to develop urban gasification, a subsidy of 300 yuan is given for each ton of standard coal conserved, why are we unable to exercise such coal conservation subsidies for hydropower?

In order to meet the demand for electricity, reduced hydropower construction will inevitably result in more thermal power construction. Currently 10 million kW of equipment is ready to be imported (mainly for thermal power). The cost of every kilowatt of imported equipment for thermal power is between 1,700 and 2,000 yuan, which is not really cheaper than hydropower construction. In the long run, the problems of coal, shipping, and environmental pollution will become greater and the burden will become heavier, and only increased hydropower construction will moderate this contradiction. Considering the interests of our future generations, we must speed up hydropower development within the next 15 years.

5. One of my main views is that we must draw up in specific terms the preferential policy for speeding up the development of large and medium-sized hydropower stations (the state does subsidize small rural hydropower stations), six points are proposed as follows:

(1) Implement shared investment for projects of comprehensive utilization, the state should allocate special fund for investment that should be undertaken beyond the scope of power generation, and the hydropower station should only be responsible for the loan repayment for the electric power portion.

(2) Hydropower investment loans must be made according to the terms of foreign loans (repayment in 30 or 40 years, with an extension of 5 to 8 years and a low interest rate of 2.4 percent).

(3) Use the low-intrest and long-term preferential government-to-government and World Bank loans for hydropower development as much as possible.

(4) Follow the method of the Hongshui He Joint Aluminum-Electric Power Corporation by practicing various forms of joint operation based on local conditions (in 1981 the vice governor of Yunnan, Zhao Zengyi [6392 1073 4135], and I sponsored a joint proposal to the State Planning Commission on joint operation between Yunnan's hydropower and phosphorus mining development), using aluminum (and other products) to repay the loan, accumulate funds and expand the scale of hydropower development.

(5) Encourage various forms of local fund raising (domestic or foreign fund is acceptable) to construct large and medium-sized hydropower stations. Preferential terms given by the state must be even more favorable than the terms for collectively funded thermal power and small hydropower projects. For instance, giving 10 to 50 percent in subsidies according to the benefits of comprehensive utilization to be determined on the basis of the specific project. Moreover, in the light of the terms of collective funding for thermal power, coal for thermal power is to be undertaken by the state, and subsidies should be given to hydropower according to the corresponding amount of coal conserved (based on an annual saving of 3 tons of coal per kilowatt and an investment of 150 yuan per ton of coal, a subsidy of 450 yuan may be given for each kilowatt).

(6) Basic depreciation and major repair depreciation for hydropower should be specially designated, the remaining portion should be used for hydropower construction.

Concerning the economic results of hydropower there is still the issue of electricity rates (peaks and valleys, high and low water flows). The relationship between hydropower stations and power grids must give consideration to the benefits of capacity, quantity, and static and dynamic states. In the past these differences were not taken into account when making arrangements and plans.

Only if we make a resolution and understand the reason why for a long time we have not been able to accomplish in hydropower that could have been speedily accomplished, we believe that other preferential ways can be found besides these six points. Of course, hydropower construction itself must do a good job in preconstruction work, lower construction cost and shorten construction time. For instance the bidding method can be practiced for survey, design and construction and we should continue to hire foreign consultants for large projects. Bidding and consulting should be used at the same time in order to develop hydropower by achieving greater, faster, better and more economical results.

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COMPLEMENTARY ROLE OF THERMAL, HYDROPOWER IN NORTH CHINA GRID

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 2, 12 Feb 86 pp 4-7

[Article by Cai Dingyi [5591 1353 0001] of the Survey and Design Academy of the Ministry of Water Resources and Electric Power: "Use the Operational Experiences of North China's Predominantly Thermal Power Grid To Acknowledge the Necessity of Combining Hydropower and Thermal Power"]

[Text] Hydropower serves best as a reserve for load regulation, frequency regulation and accidents, as everyone knows. Because he was limited either by his own prejudices or by ideological limitations, however, the author of the "Re-evaluation of the Economy of Hydropower" failed to discuss these advantages of hydropower when evaluating its economy. In contrast, he emphasized the "low utilization time of hydropower," "major losses due to redundant capacity," its "uneconomical nature" and so on. SHUILI FADIAN has published a group of articles that refute and clarify these mistaken viewpoints and I will not discuss them further here. This article will discuss the difficulties encountered in the predominantly thermal-powered North China Grid caused by the lack of hydropower load regulation to demonstrate the necessity of combined thermal and hydropower development.

I. An Overview of the North China Grid

The North China Grid is formed by the four Beijing-Tianjin-Tangshan, Nei Monggol, Shanxi and Southern Hebei grids (the Nei Monggol Grid has not been connected with the grid as of yet). The load distribution is such that the Beijing-Tianjin-Tangshan Grid accounts for 52 percent of the total grid, southern Hebei for 18 percent, Shanxi for 24 percent and Nei Monggol for about 6 percent. The distribution of motive power resources in the region is one of rich coal resources and considerably smaller hydropower resources. At the end of August 1985, the North China Grid had a total installed generator capacity of 10.27 million kW (not including self-supply power plants). This includes 635,600 kW in hydropower, or 6 percent of total installed generator capacity. Thermal power accounts for 94 percent, and high temperature and high voltage generators account for 81.9 percent of total thermal power capacity. For this reason, it is unimportant whether we consider short-term or long-term development when examining the reality of the grid and energy resource development; the North China Electric Power System must be one in which thermal power predominates. The structure of

electricity use in the grid is 75.1 percent for industry, 16.8 percent for agriculture, 7.2 percent for municipal household use and 0.8 percent for communications and transportation.

Using a typical load curve based on actual measurements made in 1982, the peak load in the grid as a whole under conditions of restricted power was 7.32 million kW, while the average daily load was γ = 89.5 to 93.7 percent. The minimum daily load β = 74 to 79 percent and the peak-to-valley differential was 1.89 to 1.52 million kW. There is some difference between this and actual loads. Based on the structure of power use loads and reduction processing of this typical load curve, the actual peak load would be 7.73 million kW and the minimum load would be 5.34 million kW. The average load would be 6.53 million kW, γ' = 84.5 percent, β = 69 percent and the peak-to-valley differential would be about 2.40 million kW. The regulable capacity of the grid was only 1.70 million kW (including 120,000 kW in hydropower), a shortage of 700,000 kW. Following rapid development of urban construction, continual improvements in the people's standard of living and the popularization of household appliances, municipal household electricity use inevitably will increase rather quickly. Although this part of electricity use is not a large proportion, it concerns everyone, and it is concentrated in time. In addition, the rate is high and there are precipitous changes in loads that will make peak regulation in grid operations even more urgent.

II. Problems and Questions in the Operation of Predominantly Thermal Power Grids

Because the North China Grid has a shortage of hydropower, it must rely on thermal power generators for peak regulation, and many problems and questions are encountered during operation practice. The main ones are:

1. A lack of peak regulation capacity has affected the quality of electric power.

In actual operation, the North China Grid has two peaks in electricity use, both in winter and summer: from 9:00 to 11:30 AM and from 18:00 to 21:30 PM. Electricity use for industry, public activities, municipal life and illumination is rather concentrated during these periods. The shortage of electric power has made it necessary for several years to adopt measures to shut off power during peak periods and to hold down thermal generator output during valley periods to guarantee safe operation of the grid. Thermal power generators currently reduce output by about 20 percent during valley periods. Although it is possible to reduce diesel generators by 40 to 50 percent, they account for only 17.79 percent of total grid capacity and play a limited role. A situation in which the fires must be extinguished in thermal power generators during operation has appeared and it is not accidental. Because of the frequent loss of power in the grid, and especially the lack of peak regulation capacity even though power is shut off during peak periods and output operations are restricted during valley periods, the quality of frequencies in the electric power system is affected. According to statistics for 1983, the rate of conformity to frequency specifications for the North China Grid was 99.12 percent. The maximum frequency was 50.24 Hz and the

minimum was 49.11 Hz. There were a total of 161 times when the grid as a whole did not meet frequency specifications and the amount of time totaled 77 hours 28 minutes and 51 seconds. The total time during which frequency specifications were not met during the first half of 1985 reached 132 hours and 54 minutes. The maximum frequency was 50.45 Hz and the minimum was 49.2 Hz. Frequency conformity to standards was only 96.94 percent, lower than specified requirements. Because of the shortage of electric power and output, the range to which declining frequencies exceeded the specified scope could affect the quality of many industrial products and the reliability of many scientific research achievements, and it leads to distortion of radio and television broadcasting, makes electric clocks inaccurate and so on, all of which directly affect the work and lives of the people. Adoption of the power shutoff power shutdowns not only causes production stoppages in some industries and restricts public activities but also is related to the daily lives, culture, recreation and so on of all the people.

2. Power outages cause economic losses.

As for the economic losses created by power outages, it is difficult at present to derive an outline of output from numerical calculations and it is only possible to derive a qualitative understanding from statistical data. Based on an analysis of statistics on power outages in the four North China, Beijing-Tianjin-Tangshan, Beijing and Southern Hebei grids from 1981 to 1983, each power shutdown on the average affected 2,000 to 3,000 kW in grid loads. In the Beijing Grid, the average load of each power outage was 100,000 kW, equal to 6.7 percent of peak load periods. The maximum reached 229,000 kW, which is no small figure. In the Beijing Steel Mill and the Beijing Special Steel Mill, for example, steel output was reduced by nearly 60,000 tons because of power outages, and the estimated losses were counted in the tens of millions of yuan. The North China Grid has a peak regulation capacity shortage of about 700,000 kW. If we use the power outage method and calculate on the basis of 4 hours per day, there would be a yearly reduction in power of 1 billion kWh. If each kWh produces about 2 yuan in value of output, the economic losses would exceed 2 billion yuan, which is quite considerable. Power outages in the Beijing region now have reached Sanhuan Road and areas near the city region, which is a serious situation.

3. Thermal-power generators have a poor peak regulation capacity and are uneconomical.

The design and manufacture of the thermal-power generators over 50,000 kW currently found in the North China Grid were done in consideration of bearing base load operations. Changes in load bearing ranged from 80 to 100 percent and these were used to start or stop peak regulation. The tendency for power shortages in the grid is becoming increasingly serious, and there are an insufficient number of hydropower generators, so it is essential that thermal power generators be used for peak regulation. In general, 8 hours are required to stop and then start up a 50,000 kW thermal power generator. Some 16 hours' time is required, however, to start up a 100,000 kW generator after it is shut down, so there is no way that they can keep up with the two peak load periods. This makes it very difficult to use shutdowns and startups of

100,000 kW generators for peak regulation. Another aspect of the poor capacity of thermal power generators for peak regulation is that they cannot cope with abrupt changes in electric power system loads. During peak load periods in the Beijing-Tianjin-Tangshan Grid, for example, the load rises by more than 100,000 kW for each 10 minutes' time and rises by 200,000 kW in 5 minutes during peak periods. If generators at the 50,000 kW capacity level and below are used for peak regulation in the system, 1 hour would be required between the time of connections to the grid and full load operation. Added to the fact that the rate of load increase cannot exceed 800-plus kW per minute, this means that generators with greater capacity can only increase their load at a rate of 2,000 to 5,000 kW per minute and cannot meet the grid's peak regulation requirements. Besides having poor peak regulation capacities, thermal power generators also are very uneconomic. At the Junliangcheng Power Plant in Tianjin, for example, which originally had a 50,000 kW oil-burning generator that later was changed over to a coal-fired one, shutdown and startup for peak regulation in a heat reserve state means that 1 hour and 10 minutes are required from ignition to full load bearing. Some 1.5 tons of oil must be burned in startup and ignition of the generator. This not only consumes a great deal of oil but also pollutes the atmosphere and affects environmental protection. Fines are levied by the Tianjin Municipal Environmental Protection Bureau every year. There now is a 700,000 kW shortage during peak periods in the grid as a whole. If fourteen 50,000 kW generators were used, then 21 tons of crude oil a day would be required for firing to start and stop them. If the cost per ton of crude oil is calculated at 120 yuan, the cost of the oil for startup and shutdown each year would exceed 900,000 yuan. If generators with a capacity greater than 50,000 kW were used, even greater amounts of oil would be needed for startup and shutdown, which is even less economical. In addition, unit [energy] consumption in the thermal power generators used to bear base loads is high during reduced output operation in valley periods. According to foreign data and statistics on the unit standard coal consumption of thermal power generators during different average output periods, fuel consumption increases by more than 80 percent during reduced output operation in valley periods compared with basic load operation periods, which also creates economic losses. The higher fuel consumption, the power used in the plants and the expenses for operation and maintenance of thermal power generators used for peak regulation means that there is a corresponding increase in the cost of electricity generation. According to statistics from some thermal power plants used for peak regulation in the North China Grid, the cost of supplying electricity is 12 to 25 percent higher than average costs in the grid.

4. The frequent startup and shutdown of thermal power generators used for peak regulation affects equipment life.

Frequent startup and shutdown of the generators and boilers not only requires large amounts of oil for firing but also affects equipment life and increases the number of inspections and repairs. Thermal powered generators are thick-walled metallic devices. Frequent startup and shutdown and the subsequent changes in output lead to changes in the mechanical loads and stresses of each component. In addition, changes in temperature can lead to metal fatigue and cracking in some components. Wear on the steam seals causes separation

of the turbine and the steam chamber, which increases steam leakage. Steam consumption also is greater and thermal efficiency is lowered. When a 50,000 kW generator is used for base load operation, for example, major repairs require 22 days. When used for peak regulation operation, major repairs require 35 to 40 days. Because of the frequent operation, not only is the intensity of workers' labor increased but accidents also are more likely.

The problems in operation of the North China Grid and the economic losses described above are based only on a rough analysis of some statistical data and are not very accurate. They do, however, provide a qualitative indication of the seriousness of the problem and of the enormous economic losses.

III. To Improve the Operational Conditions of the North China Grid, We Also Must Strive To Develop Hydropower and Link the Northwest and North China Grids

The speed of startup in hydropower generators is much more flexible than for thermal power generators. Full load operation can be achieved within just 2 to 3 minutes after startup, and they can be used to meet grid peak regulation requirements. Besides peak regulation, hydropower and pumped-storage power stations located near load centers also can be used for frequency regulation, phase regulation and accident reserve. If the North China Grid had one or two hydropower stations (or pumped-storage power stations) with peak regulation capabilities like the one at Xin'anjiang to take over the task of peak regulation, there would be a very noticeable change in the operational situation in the North China Grid and most of the problems outlined above could be avoided. Shutdowns and power restrictions could be reduced or even eliminated, which would be extremely beneficial to industrial and agricultural production and the peoples' lives. We can see from this that the position and role of hydropower in a power network is extremely important and obvious. For this reason, we must make a great effort to link up the Northwest and North China Grids if we are to improve the operating conditions of the North China Grid. The concrete measures are:

1. Connect with the Northwest Grid to "transmit electricity from west to east." "Transmitting electricity from west to east" actually would involve joint operation of hydropower and thermal power to make full use of the advantages of the northwest and northern regions, and it would conserve fuel and reduce water wastage. "Transmitting electricity from west to east" also could utilize the east-west time differential and achieve peak regulation to benefit from staggered loads according to the peak loads of different industrial structures and agricultural seasons. To transmit power from the northwest to northern China, however, there are limitations to the capacity for power transmission over long distances and line losses also are considerable, so it would still be difficult to achieve a solution to the operational problems of the North China Grid by relying completely on "transmitting electricity from west to east."

Local development of northern China's limited hydropower and substantial efforts to build pumped-storage power stations are important measures for improvement of the operating conditions of the North China Grid. Preliminary planning and design work on developable hydropower resources in north China

already has been carried out for hydropower stations at Zijingguan on the Juma He, at Xiangyangkou on the Yuanding He, and Qingshiling and Liangpingtai on the Bai He, at Wanjiazhai on the northern trunk between Shaanxi and Shanxi in the upper reaches of the Huang He and other locations. Total installed capacity exceeds 2 million kW and sites near load centers can be selected to achieve further development of hydropower with its obvious safe operation benefits. According to statistics, one shutdown in the grid reduces loads by 2,000 to 3,000 kW on the average. If the second cascade at Xiangyangkou on the Yuanding He can be built and put into operation (with guaranteed output of 6,300 kW), the number of grid shutdowns could be reduced by a certain number, so its role would be extremely apparent.

Because of the similarities in the peak regulation capabilities of pumped-storage power stations compared with conventional hydropower stations, both can regulate peaks and fill in valleys. One kW in installed pumped-storage generator capacity can provide 2 kW in peak regulation capacity, so the peak regulation capacity of pumped-storage power stations is double their working capacity. Such power stations can be started up quickly, and they are flexible and reliable. They can serve for system peak regulation and accident reserve power sources, and they also can be used for frequency regulation and phase regulation to improve safety and stability in grid operation, to improve the quality of electricity supplies and to improve the reliability of electricity supplies. China installed three 11,000 kW pumped-storage generators at the Gangnan and Miyun Power Stations during the 1960's that have played a certain role in the system, and three 80,000 kW pumped-storage generators have been installed in the power station at the already-completed Panjiakou reservoir. In addition, after more than a decade of surveying, planning, site selection and feasibility research and design work, consideration can be given to construction of pumped-storage power stations at Shisanling in Beijing, at Guanting, Neiwa and Mengdaihai in Hebei and so on. The geographical position of the Shisanling and Gunating pumped-storage power stations, which would have a design total installed capacity of more than 3 million kW, is such that they are near load centers and could play an excellent role in grid peak regulation, frequency regulation, phase regulation and accident reserves. Moreover, the use of already-built reservoirs could reduce investments and speed up construction schedules, so action should be taken to accelerate the pace of construction.

Through the routes listed above, we are confident that a suitable proportion of hydropower for peak regulation tasks in the predominantly thermal North China Grid could lead to substantial improvements in grid operations. There is no doubt that the economical nature of operating a combined thermal and hydropower network will continue to be greatly improved.

The goal of the author in writing this article has been to use the North China Grid, a predominantly thermal power network, as an example of the real situation of a great many difficulties throughout the grid in the area of regulated operation that are caused by the lack of hydropower for peak regulation and to show the necessity of combined development of thermal and hydropower. This is not some sort of "sectoral bias." In reality, the internal structure of an industry is relatively complex and only those who

have worked in this sector for many years can truly understand the things that are its essence and know what is the most economical approach and what is not economical. The thing that worries everyone is that some comrades do not have a full understanding of the situation in the industry and do not dare to listen to opinions. They are content with half an understanding and do not base their conjectures on reality. The conclusions they draw cause many things to be ignored and they feel that "only they know all things under heaven." Instead, they feel that they "have no biases." I have written these last comments specifically for the author of the "Re-evaluation" and for discussion.

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IMPORTANCE OF TIANHUANGPING PUMPED-STORAGE STATION REITERATED

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 2, 12 Feb 86 pp 48-49

[Article by Xu Hongliang [1776 3163 0081] of the Central Water Conservancy and Hydropower Construction Bureau of the Ministry of Water Resources and Electric Power: "Construction of the Tianhuangping Pumped-Storage Power Station Should Be Speeded Up"]

[Text] The Tianhuangping pumped-storage power station is an extremely important project for solving the inadequate peak regulation capacity in the east China region. The Survey and Design Academy of the Ministry of Water Resources and Electric Power is actively engaged in work on a feasibility study and it is possible that it may submit a report in April 1986.

The Tianhuangping pumped-storage power station is located in Anji County in the northern part of Zhejiang Province, 175 kilometers from Shanghai, 180 kilometers from Nanjing and 57 kilometers from Hangzhou. It is 17 kilometers from the 500 kV power transmission line running from the Lianghuai region to Shanghai and 31 kilometers from the 500 kV Pingyao transformer station. The power station is composed of upper and lower reservoirs, a water transmission system, an underground plant building, a primary tranformer room, an outdoor switching station and so on. The natural bottoms of the upper and lower reservoirs have an elevational difference of 605 meters. The average head may reach 568 meters after the reservoirs are built. The effective reservoir capacity will be 5 to 7 million cubic meters and daily energy storage will be 5.3 to 7 million kWh. The plan is to install four to six generators with a total installed capacity of 1.2 to 1.8 million kW. The upper and lower reservoirs are very close in terms of horizontal distance and there are 1,390 meters of penstocks. It will have 2.45 times the head of average power generation, conditions that are relatively superior to most of the world's pumped-storage power stations.

This pumped-storage station project is located in a region of igneous rock and the bedrock is massive rhyolitic lava tuff, rhyolite-porphyry and granite-porphyry, so there are no major regional structural problems. The geological conditions of the upper and lower reservoirs, the plant building, the water transmission system and other underground projects are rather good.

The upper reservoir is located in a natural depression that lies between the two mountain ridges of Tianhuangping and Getianling. The normal high water

level is between 900 and 906 meters in elevation with a corresponding reservoir capacity of 5 to 7.3 million cubic meters. The upper reservoir has one primary dam which is about 74 to 81 meters high and about 500 meters long. In addition, there are three auxiliary dams, all of them less than 30 meters tall. The construction site is open and local materials can be used to build the rock-fill dams. For an installed capacity of 1.2 to 1.8 million kW, total rock excavation for the dam of the upper reservoir will be 2.7 to 3.5 million cubic meters and 1.63 to 2.14 million cubic meters of rock fill will be used for the body of the dam.

There will be two to three water diversion tunnels and the underground water diversion channels running from the water intake to the branch channels will be about 1,000 meters long and have an inner diameter of 5.4 meters. With an installed capacity of 1.2 million kW, the main plant building will be about 24 meters wide, 54 meters high and 155 meters long. No pressure regulating wells will be installed at the tail of the water diversion tunnels. With an installed capacity of 1.2 to 1.8 million kW, the overall water diversion system and the underground plant building will require open excavation of 280,000 to 300,000 cubic meters of rock, tunnel excavation of 420,000 to 580,000 cubic meters of rock and pouring of 117,000 to 190,000 cubic meters of concrete.

The lower reservoir is located on a large branch stream of the Xitiao Xi in the Tai Hu basin. The catchment basin above the dam site covers 25.5 square kilometers and the long-term average runoff at the dam site is 25.90 million cubic meters. The 95 percent guaranteed yearly runoff is 12.00 million cubic meters, so the water sources are rather complete and can guarantee water reserves during the early period of the power station and supplementary water supplies for normal operation. The innundation losses of the upper and lower reservoirs are very small in comparision with conventional power stations at the same scale. The dam site and shape of the dam of the lower reservoir now are being compared. The geology and terrain both provide suitable conditions for the construction of a compressed concrete gravity dam, an arch dam or a steel-reinforced concrete rock fill dam. If a gravity dam program is adopted, the top of the dam will be about 320 meters long and 94 meters high. An arch dam program would involve the excavation of 355,000 cubic meters of stone and the pouring of 230,000 cubic meters of concrete.

Preliminary estimates of the investments per kW at the power station, regardless of whether the 1.2 million kW or 1.8 billion kW program is selected, are that they may be no higher that the unit investment per kW at thermal power plants. The predicted construction period is 5 to 6 years.

Pumped-storage power stations have very obvious advantages in that they can exchange 4 kWh during valleys for 3 kWh during peaks. This was pointed out especially clearly in the State Council's Circular 72 (1985), the "Provisional Decisions on Encouraging the Raising of Capital for Power Construction and Implementing Electricity Rates" "the price of electricity during valley periods can be 30 to 50 percent lower than current electricity prices, while the price of electricity during peak periods can be 30 to 50 percent higher than current electricity prices." This not only will

enable pumped-storage power stations to play a role in grid peak regulation, conserve fuel and guarantee normal system operation, but it also has economic advantages. The economic benefits of pumped-storage power stations remain to be acknowledged by larger numbers of people in China, and as a result suitable locations for construction of pumped-storage power stations still have not been given the proper status.

The energy shortage in the East China region has been around for many years, whereas the demand for electricity for industrial and agricultural production and for the people's use has grown very quickly. There is not only a shortage of electric power but even more important is that there is an inadequate peak regulation capacity. According to power sources and grid development plans in the East China Power System, a group of pit-mouth, harbor, and junction power plants will be expanded and built during and after the Seventh Five-Year Plan. In addition, nuclear power, Gezhouba, and the Shuikou power stations will go into operation and continue to produce electricity. These will create excellent power reception conditions for the Tianhuangping pumped-storage power station.

The Tianhuangping pumped-storage power station has been selected by the Survey and Design Academy of the Ministry of Water Resources and Electric Power as the best from among more than 10 rather advantageous dam sites. After its completion, this station can greatly increase the East China Grid's peak regulation capacity, and it will improve the operational reliability and economy of the power system. For this reason, we ask that the concerned leadership departments work as quickly as possible to make the decision and begin action as soon as possible.

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THREE GORGES: DEBATE CONTINUES OVER CONTROVERSIAL PROJECT

Hong Kong TA-KUNG-PAO in Chinese 31 Mar, 1 Apr 86

[31 Mar 86, p 1]

[Text] The Three Gorges Key Water Conservancy Project, which now is in the design stage, has become known by the world as China's largest dam. On 15 November 1984, State Council Vice Premier Li Peng [2621 7720] announced that China had decided to build the enormous Three Gorges hydropower station and welcomed foreign countries to cooperate with China in construction of this huge project. The governments and business circles of many nations have expressed interest and several have come to investigate and discuss it.

Members expressed a variety of opinions at the 3d Session of the 6th National Political Consultative Conference held during spring 1985 and proposed that the Three Gorges Project not be built or that its construction be delayed. Some members indicated that they would "admonish with falling tears." The Economic Construction Group of the Conference organized a survey group that carried out a 38-day investigation and issued a report in July which took the position that there were many disadvantages and few benefits from the Three Gorges Project, and the group proposed that "it could not begin within the short term, or at least could be begin during the Seventh Five-Year Plan."

In October 1985, the Advisory Group of the Construction Preparation Office of the China Three Gorges Project Development Corporation also wrote the "Opinions Conerning the Report of the National Political Consultative Conference Economic Construction Group Regarding an Investigation of Problems at the Three Gorges Project" (referred to hereafter as the "Opinions"), which offered different views regarding the theses and arguments made by the Conference in the report on its investigation.

In the most recent National People's Congress, the Three Gorges Project was not included in the Seventh Five-Year Plan, which indicates that the central government wishes to hear opinions from all sides, including those of experts, and that it has a strict attitude of responsibility to the people.

This reporter recently visited relevant persons in Yichang City in the Gezhouba Project Bureau and the China Three Gorges Project Development Corporation Construction Preparation Office to gain an understanding of the situation in the Three Gorges Project, for which preparations for construction are now in progress.

I. Development of the Three Gorges Project Is a Long-Cherished Wish of Our Nation

The Chang Jiang is the world's third largest river, surpassed only by the Amazon and Congo Rivers. The Chang Jiang has roaring waves and contains especially rich hydropower resources. The most recent surveys and calculations estimate that it contains about 40 percent of China's hydropower resource reserves.

The banks of the Three Gorges Project are dangerous vertical walls and the water flows fiercely. The hydropower reserves there are exceptionally rich--there is no better dam site--and development of the Three Gorges Project exploit advantages and eliminate disadvantages has been a long-cherished dream of the Chinese people.

Mr Sun Yat-sen, the pioneer of China's Democratic Revolution, pointed out in his "Program for National Development" that "moving up from Yichang and into the gorges, improvement of the upstream section and the use of locks to dam the water could provide passage for boats and also permit the use of its hydropower." Although Mr Sun Yat-sen visited the site, he was unable to achieve his wish.

The Guomindang government sent people to investigate the Three Gorges river section in the winter of 1932. A development plan for the Three Gorges was formulated and Gezhouba as well as the area between Huanglingmiao and Sandouping were selected as the two dam sites most suitable for construction of a power station. Mr Yun Zhen [1926 7201], the primary architect of this development plan, is alive and well even today.

Director Weng Wenhao [5040 2429 3493] and Deputy Director Qian Changzhao [6929 2490 3564] of the Guomindang government's Resource Commission recruited the famous dam engineer Dr (Safanji) to survey the Three Gorges in 1944. (Safanji) had designed 60 large dams during his lifetime that included four of the world's largest dams at the time. He expressed great interest and braved the cannons of the Japanese invaders to examine Xiling Gorge. Assisted by Chinese technicians, he worked for 40 days and completed the famous "Preliminary Report on the Yangzi Jiang Three Gorges Plan" (also known as the "(Safanji) Program").

In March 1946, he returned to the Three Gorges section for a 9-day survey of the area around Nanjinguan. He stated boldly that "development of the Three Gorges Plan would involve power generation, flood prevention, nvaigation, irrigation, industry, agriculture, and other areas. It would be related not only to the prosperity of China but also would be a magnificent project on an international scale." He said at a press conference that "the natural

conditions of the Chang Jiang Three Gorges are China's alone, since there are no others in the world like them. This is wealth that God has given the Chinese people. If God would allow me the time to see the Three Gorges Project come to fruition, my soul would certainly find peace in the Three Gorges after my death."

In May 1946, the Guomindang government organized the Three Gorges Hydroelectric Power Project Study Commission and it set up a national hydroelectric power engineering team in July and established the Three Gorges Survey Office in August. Surveys of the reservoir regions at the dam site, geological surveys and exploratory drilling, economic surveys and soil surveys also were undertaken in succession. The China Resources Commission signed a contract with the United States Bureau of Reclamation for design of the large Three Gorges dam. Xu Huaiyun [1776 2037 0061], Dr (Safanji's) student, led 46 Chinese technicians to the United States to participate in joint design work for the Three Gorges Project.

Because it was so determined to fight a civil war, however, the Guomindang government basically had no interest in building this large dam and recalled its engineering personnel from the United States in May 1947. On May 15 the CENTRAL NEWS AGENCY announced that "on-site work on the Three Gorges hydroelectric power project has been stopped temporarily by the Resources Commission on orders of the Guomindang government." Zhang Guangdou [1728 0342 2435], deputy chief engineer of the National Hydropower Engineering Office, wrote in an article that the "ideals and dreams of the Three Gorges Project will be achieved one day."

After the establishment of New China, the Chinese Government was very concenred with planning on the Chang Jiang. The State Council established the Chang Jiang Hydropower Commission, and Premier Zhou Enlai appointed himself chairman. He pointed out that elimination of danger and expansion of benefits on the Chang Jiang would require comprehensive planning focused on the Three Gorges. Chairman Mao Zedong and Zhou Enlai themselves chaired a conference that formulated an outline program for development of the Three Gorges, and they also made personal visits to the Three Gorges.

After the 1954 flood on the Chang Jiang, Mao Zedong reaffirmed that the Three Gorges were the core of the strategy for controlling the Chang Jiang. At the beginning of 1958, Premier Zhou led an on-site inspection by responsible persons from the various central ministries, provinces and cities, and the CPC Central Committee gave a report concerning the Chang Jiang basin and the Three Gorges Project at its Chengdu Conference. The conference discussed the Three Gorges Project and planning in the Chang Jiang basin and issued the "Opinions Concerning the Threee Gorges Project and Planning on the Chang Jiang." Premier Zhou chaired the Chang Jiang Three Gorges Conference at Beidaihe in August 1958. During the 1960's the Chang Jiang Basin Planning Office and related scientific research departments carried out multipurpose studies and discussions concerning the Three Gorges Hydropower Project. At the beginning of the 1970's, construction of the Gezhouba

Project caused design and scientific research work on the Three Gorges Project to become the order of the day once again.

The CPC Central Committee and the State Council became extremely concerned with construction of the Three Gorges Project after the 11th CPC Central Committee and accelerated the pace of scientific research and design for the Three Gorges Project. In March 1984, the State Council convened a Three Gorges Project Feasibility Report Conference attended by more than 300 specialists at Beijing that examined and approved the Three Gorges Project Feasibility Study Report.

II. The Primary Goal of the Three Gorges Project Is Flood Prevention

The Chang Jiang is a rain-fed river and experiences numerous thunderstorms during the rainy season each year that cause severe flooding in the middle and lower reaches. During the 2,000-plus years between the Han Dynasty and the end of the Qing Dynasty, there was a flood on the average of once every 10 years. The large levee on the Jing Jiang has been breached 60 times over the past 300 hundred years. Especially major flooding has occurred twice during the past 10 years.

In late June of 1879, thunderstorms rolled across the southern flank of the Daba Shan, the Qu Jiang, the lower reaches of the Jialing Jiang and Fu Jiang and the Three Gorges region. In Hechuan County, located in the lower reaches of the Jialing Jiang, the "rain fell in sheets for 3 days," while Siqikou in Chongqing "saw major rains for 10 days and for 7 days materials and people were carried off by the river." The Annals of Wanxian County record that "the river was full on 15 June and a heavy rain fell on the night of the 19th, collected over a wide area and flooded the county seat." In July the enormous flood passed through the Three Gorges in the upper reaches of the Chang Jiang and flowed directly into the Jingyi region. Below Yichang there were 19 major breaches of levees and almost 30 counties in the middle reaches saw all of their land flooded and all buildings destroyed.

The 1931 flood was not a particularly major one, but the large Jing Jiang levee burst, drowned 145,000 people and left nearly 30 million people homeless.

After the establishment of New China, the governmen- established a flood diversion region on the southern bank of the Chang Jiang and it built flood diversion gates on the Jing Jiang and made large-scale repairs on the large Jing Jiang levee. The 1954 flood was not as large as the one in 1870 and the water level in th[illegible]ping Xi section of Xiling Gorge was 10 meters lower than in 1870. T[illegible]ning of the flood gates to divert the water protected the large Jing J[illegible] levee, safeguarded the three cities that make up Wuhan and protected the Jiang-Han Plain. There was still serious flooding, however, and it severed the Beijing-Guangzhou Railway for 100 days, drowned 30,000 people, flooded 47 million mu of farmland and caused losses to 18.8 million

people. According to statistics from the relevant departments, the occurrence of a flood today like the one in 1954 with ideal regulation of floodwater diversion and storage regions would cause direct losses of 21 billion yuan and indirect losses that would be incalculable.

To remove this "Sword of Damocles" that hangs above the head of the tens of millions of people living in central China, we must build the Three Gorges Project.

There are multiple high, medium and low design programs for the project (involving dam heights of 195, 185 and 175 meters). It would be difficult for any other project to replace the important flood prevention role of the Jing Jiang and the section [of the Chang Jiang] below it. The original plan was to build according to the low dam program (with a dam elevation of 175 meters above sea level and a normal water storage level of 150 meters above sea level). The excess-storage flood prevention reservoir would have a capacity of 22 billion cubic meters. If a flood of a severity seen every 100 years were to occur, the project would guarantee that there would be no breaches of the large Jing Jiang levee and that no floodwater would be diverted into the Jing Jiang flood diversion region. A flood of a severity that occurs at a frequency of more than 100 years but less than 1,000 years would only require that the Jing Jiang flood diversion gates be opened to divert the floodwater, and it also would prevent collapse of the large Jing Jiang levee, so losses would be kept to the minimum. For this reason, the Three Gorges Project should be built, even if only for the purpose of flood prevention.

[1 Apr 86 p 3]

[Text] The "Investigative Report" of the Chinese People's Political Consultative Conference [CPPCC] states that the Three Gorges project will play too great of a role in the middle and lower reaches of the Chang Jiang. The reasons are that floodwaters in the river in Sichuan are insufficient to cause flooding in the middle and lower reaches and the Three Gorges reservoir will have a limited flood prevention capacity.

The "Opinions" state that although the sources of floodwaters in the middle and lower reaches of the Chang Jiang are complex, the floodwater in the rivers of Sichuan are the main component. During this century, floodwaters passing through Yichang during the 2-month rainy season in July and August have accounted for 60 to 80 percent of the total amount of floodwater in the Chang Jiang. The 1860 and 1870 floods in the middle and lower reaches were not especially major ones, but the peak flow rates at Yichang reached 92,500 cubic meters per second and 105,000 cubic meters per second, respectively (the annual average is 14,300 cubic meters per second). They broke through at Ouchi and Songzi and caused serious losses in the two lakes. The theory that Sichuan river floodwaters are insufficient to cause disasters in the middle and lower reaches is unrealistic.

The "Opinions" also state that the key question in flood prevention in the middle and lower reaches is the large Jing Jiang levee. A large amount of work has been done over the past 30-plus years to repair the levees, open up flood diversion and storage regions and build reservoirs on the tributaries. There have veen obvious improvements in the flood prevention capabilities in the middle and lower reaches of the Chang Jiang, including flood diversion and storage on the Jing Jiang, which can just handle 80,000 cubic meters per second. If, however, the peak flow rate in the upper reaches exceeded 80,000 cubic meters per second, there would be no feasible countermeasures. There have been eight instances over the past 800 years when the flow rate in the upper reaches of the Jing Jiang has exceeded 80,000 cubic meters per second and five instances when it has exceeded 90,000 cubic meters per second. The primary role of the Three Gorges project would be that if such a flood occurs, it could link up with dike and flood diversion projects in the middle and lower reaches to reduce peak flow rates to less than 80,000 cubic meters per second and thereby avoid disastrous flooding. It does not require that it be substituted for flood diversion in the middle and lower reaches. The flood prevention reservoir capacity of the Three Gorges is not significant when compared with the amount of flood water that must be diverted and stored in the middle and lower reaches.

The "Investigative Report" states that the Three Gorges project would increase the danger of flooding in the upper reaches: "in the '180 Program' (referring to a dam height of 195 meters and a normal water storage level of 180 meters), a flood of a severity that occurs every 100 years would raise the water level at the middle of the dam to more than 190 meters...the water level at Chongqing would exceed 210 meters..." The "Opinions" state that this indicates a lack of understanding of the original design. The highest water storage level in the 180 Program during the dry season would be 180 meters, whereas the water level during the rainy season would be restricted to 150 meters. A flood of a severity occurring every 100 years would raise the reservoir water level to 175 meters and a flood of a severity occurring every 1,000 years would not exceed 180 meters, so there would be no question of the "water level rising to 190 meters in the middle of the dam" or the "water level at Chongqing reaching 210 meters." Programs with water storage at a lower level would have no such problem.

The "Investigative Report" states that "if the intent is to control the danger of flooding on the Chang Jiang, the Three Gorges reservoir would be useless. The starting point should be the source of floodwaters in the Chang Jiang and the areas prone to thunderstorms on its tributaries, and we should strive to decentralize the obstructions and integrate dredging with flood diversion."

The "Opinions" state that this method is detached from real conditions on the Chang Jiang. According to incomplete statistics, about [illegible] large-and medium-sized reservoirs have been built on the tributaries of the Chang Jiang since the nation was founded and several tens of them are now under construction. Some tributary reservoirs (like the Danjiangkou reservoir) play substantial roles in flood prevention on their tributaries. Because the Chang Jiang river basin covers such a large area and has so many tributaries, however, the formation of the floodwaters in the trunk is complex and the role of tributary reservoirs in flood prevention is not obvious. In terms of controlling floodwaters in Sichuan's rivers, the Chang Jiang plan calls for about 19 reservoirs

on the trunk above the Three Gorges with specific flood prevention roles (including three that have been build and one now under construction). If used in conjunction with the Three Gorges reservoir, they could play a definite role in flood prevention in the middle and lower reaches. This is especially true since with this group of reservoirs there still is an area of 300,000 square kilometers within the Three Gorges region that cannot be controlled, so the danger of flooding in the middle and lower reaches cannot be eliminated. Although there are problems related to the construction of the tributary reservoirs, it does not mean that they cannot be completed.

I. The Power Generated Would Be Equivalent to One-Sixth the National Total

Total annual power generation in China in 1985 exceeded 400 billion kWh, but severe power shortages persisted and were especially severe in the east and central China regions. Nevertheless, the enormous hydropower resources of the Chang Jiang flow away unused. The famous water conservancy specialist Lin Yishan [2651 0001 1472] once said that "the spring waters in the river flow eastward and all of the flow is coal and oil."

Construction of the Three Gorges project would change this situation. According to the feasibility study report approved by the State Council in 1984, the Three Gorges Key Water Conservancy Project would be composed of a spillway dam, a non-spillway dam, a power station plant building, two four-level boat locks, a single-line vertical lifting boat lock and other components. There would be a total of 26 generators installed in the power station plant building, each of them with a capacity of 500,000 kW, so the total installed generator capacity would be 13 million kW. Average yearly power output would be 67.7 billion kWh, equivalent to one-sixth of total yearly power output in China at the present time. This would be the equivalent of more than 35 million tons of raw coal or 18 million tons of petroleum.

The Three Gorges power station would be located in central China. It has a suitable geographic location, since Shanghai, Beijing, Guangzhou and other areas of concentrated electricity use are within 1,000 kilometers or so of the Three Gorges power station, which is within the radius of economical power transmission. With the large installed generator capacity of the Three Gorges power station and the considerable regulatory capacity of the reservoirs, connection with the large grid nearby would provide enormous benefits from mutual compensation and promote the formation of a nationally unified power system.

The Three Gorges project not only would produce large amounts of electricity but would also have high economic results. The power station would sit across the Chang Jiang and the annual utilization time would be 5,200 hours. For this reason, construction of the Three Gorges power station is of especially great significance for meeting the demand for electricity needed to develop the national economy in the middle and lower reaches.

The CPPCC's "Investigative Report" states that the installed generator capacity for the 150 Program at the Three Gorges project would be 13 million kW. If the total investments as proposed in the program are 2[illegible] billion yuan, the economic results of power generation would not be bad, but their investigation indicated

that the total investments would exceed 60 billion yuan, so the unit investment would be 4,600 yuan per kW. If interest is not figured in, the total investments still would exceed 31 billion yuan and unit investments would be more than 2,300 yuan per kW. When compared with the 1,600 yuan per kW figure for several of the large-and medium-scale hydropower stations now under construction, the benefits obviously could not be considered good.

The Report also states that since a long construction period would be required, there would be only inputs and no outputs for more than 10 years after work got underway. It would not play its true role until after the year 2000, so it not only would take up a large amount of construction capital but also would require the abandonment of many construction projects urgently needed for quadrupling [the gross value of industrial and agricultural output by the year 2000].

The "Opinions" state that the high construction costs and poor benefits at the Three Gorges project mentioned in the CPPCC report are an erroneous conclusion resulting from comparisons with other hydropower stations made under unequal conditions.

According to the 150 Program for the Three Gorges, 1.76 cubic meters of concrete would have to be poured and 6.32 meters of stone and earth excavated for each kW. The average figures for hydropower stations whose construction was started between 1980 and 1985 were 3.91 cubic meters and 12.62 cubic meters, respectively, which are 2.2 and 2 times greater than at Three Gorges project, respectively.

Some people have suggested that 20 large-and medium-scale hydropower station be built instead of the Three Gorges project, which is the so-called "substitution program."

Preliminary design programs have been prepared for only six of these 20 hydropower stations and there are only preliminary plans for the remaining 14. No preparatory work has been done and there would be no way to begin construction within the next several years. An analysis of the six power stations for which design programs have been prepared indicates that the average figures per kW are 2.65 cubic meters of concrete and 11.96 cubic meters of rock and earth excavation, which are 1.5 and 1.9 times greater than the Three Gorges, respectively. In terms of the number of people who would have to be resettled, the figure for the Three Gorges would be 382 people per 10,000 kW (calculated according to total resettlement of 500,000 people). The average number for the six power stations would be nearly 399 people. The figure per 100 million kWh would be 738 people at the Three Gorges and 1,443 people on the average for the six power stations. Added to the excellent geological conditions at the Three Gorges project, it would be impossible for the unit construction costs to be higher than for the other hydropower stations now under construction.

As for "long construction time, slow output," the "Opinions" state that when the Three Gorges project is compared with single large-and medium-scale hydropower stations at a much smaller scale, the actual construction times would be longer and outputs would be slower in coming. If compared with a group of hydropower stations of equivalent installed generator capacity and output, however, the situation would be the opposite. Construction of a hydro-

power station with an installed generator capacity of 1 million kW would require a period of 8 to 9 years before power generation began, while the figure for the Three Gorges is 11 years. After the first group of generators at the Three Gorges power station begin operating, however, it would be equivalent to the completion of two power stations with an installed generator capacity of around 1 million kW. The amount of power generated between the beginning of operation and completion of the project could be 27 billion kWh, so the speed of output cannot be compared with other hydropower stations. It is a construction project with substantial reserve strengths.

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POWER MINISTRY TO RESUBMIT SANXIA FEASIBILITY REPORT

HK060315 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0931 GMT 5 Jul 86

/Text/ Beijing, 5 Jul (ZHONGGUO XINWEN SHE)--This reporter was informed today by the Ministry of Water Resources and Electric Power that the Sanxia project demonstration leading group under the Ministry of Water Resources and Electric Power will seriously implement the "Circular of the CPC Central Committee and State Council on Problems Concerning Demonstration Work of the Chang Jiang Sanxia Project," solicit opinions extensively, and submit a feasibility report on the Sanxia project again based on careful studies and demonstration.

The 10 topics of the new Sanxia project feasibility report include geological, seismological, and hydraulic structures; hydrology and flood prevention; silt and shipping; planning of power systems; submersion of reservoirs and the migration /of people/ ecology and environment; an overall plan on water level; construction; investment; and economic assessment. The first stage of the demonstration work which covers the former six topics will be completed before the end of this year, while the second stage of the demonstration work which covers the latter four topics will be completed by the end of 1987. The second stage of the demonstration work will be carried out alternatively with the first one.

Qian Zhengying, minister of water resources and electric power and head of the Sanxia project demonstration leading group, presided over the first meeting of the Sanxia project demonstration leading group held from 23-24 June in Beijing. The participants conducted careful discussions on implementing the "Circular of the CPC Central Committee and State Council on Problems Concerning Demonstration Work of the Chang Jiang Sanxia Project" and decided on the target, methods, items, stages, and organizational work of the Sanxia project demonstration leading group.

The participants unanimously held that the achievements made in the past should be used while conducting demonstration work. The achievements include survey, scientific research, design, and other preparatory work made over the years and the plan on water level demonstrated by the State Scientific and Technological Commission and State Planning Commission. The new Sanx'a project feasibility report should be drawn up on a strictly scientific basis and should stand the test of time.

/12228
CSO: 4013/148

SHUIKOU HYDROPOWER STATION CONSTRUCTION UPDATE

Hong Kong MING PAO in Chinese 10 Mar 86 p 6

[Article by Liu Ma [0491 3854]: "Problems at the Shuikou Power Station"]

[Text] A friend who works in an electric power department called me on 26 February 1986 with the latest news on construction of the Shuikou hydropower station on the Min Jiang. On 14 February, a World Bank appraisal group led by Mr. (Qintelun) arrived in Fuzhou for a formal review of World Bank loan utilization at the Shuikou hydropower station and also decided upon the amount of the loan. The decision was that international bids would be invited and that construction of the main part of the project would be delayed until that time.

The Shuikou hydropower station, which will require an investment of about 2 billion yuan, is the largest hydropower station in southeastern China at the present time. The total installed generator capacity is 1.4 million kW and annual power output is 4.95 billion kWh. It will be capable of generating at least 260,000 kW even during the dry season. This is Fujian Province's largest construction project over the last 30-plus years and it also is one of four large hydropower stations to be built in China during the Seventh Five-Year Plan. Future construction of the Shuikou hydropower station not only may permit a complete transformation of the backward situation of a 100,000 kW power shortage in Fujian at present, but it also will play a major role in electrification of all of Fujian and aid in solving East China's power shortage.

Survey and design work on the Shuikou hydropower station began in 1958, but formal selection of the reservoir and dam site was delayed until 1978. These 20 years of trials and hardships permitted many of the setbacks and bumpy roads at the Shuikou hydropower station to be overcome.

Not long ago, Fujian Province CPC Committee Secretary Xiang Nan [7309 0589] re-emphasized that the central government already had formally included the Shuikou hydropower station in key state construction projects and that there could be no further wavering, passing the buck or delays. We must be firm in starting to build according to the original program.

The hints in Xiang Nan's statements of course refer to something. As early as several years ago, a retired advisor from the Fujian Provincial Government wrote the CPC Central Committee several times expressing his strong opposition to construction of the Shuikou power station. His reasoning was that since the Shuikou power station would block the Min Jiang, it would flood a large area of mountains, forests and farmland on either bank and seriously damage the ecological balance.

Related departments in the central government paid considerable attention to his opinions and the State Science Commission in July 1982 invited more than 50 experts to a meeting in Beijing to discuss the topic. The conclusion of the discussions was that construction of the Shuikou power station would have no negative effects on the ecological balance. Just the opposite, there would be many different economic benefits from the power station after its completion: besides power generation, it also could improve the narrow shipping channels, since the boat locks at the large dam would be able to handle 500-ton flotillas and the yearly freight handling capacity could be increased more than 10-fold; the reservoir of the large dam would be a natural aquatic breeding area; the water level would rise after completion of the large dam and larger amounts of farmland on either bank could be irrigated, which would guarantee harvests despite drought or waterlogging; moreover, man-made lakes and ponds could be used to develop tourism. With so many advantages, why not go ahead with it? For this reason, the World Bank pre-appraisal memorandum stated that "long-term and intensive consideration has been given to this project and detailed analytical research has been carried out. It is in basic conformity with relevant World Bank and Chinese laws and stipulations." The theory of environmental damage is merely a groundless fear.

After this meeting, the State Planning Commission formally approved the planning tasks of the Shuikou hydropower station in August 1983 and work on the station began. Those who opposed it, however, did not relax, but instead proposed that a nuclear power station be built instead of the hydropower station. Chief Engineer Hu Xilan [5170 6932 5695] with the Fujian Province Power Bureau explained by saying that the generator sets used in nuclear power stations have a large capacity and cannot be used in power grids of relatively small scale. Moreover, the Fujian Province grid will not have the technical conditions for grid linkage in the short term. The investments required for construction of a nuclear power station would be double those needed for the Shuikou hydropower station and construction times would be much longer. For these reasons, it would not be correct to neglect Fujian's rich hydropower resources and pursue construction of a nuclear power station.

It is evident that those who oppose construction of the Shuikou hydropower station do not have an accurate understanding of the actual situation at this power station. Even when facts have proven them wrong, they continue their strict opposition. This requires research to determine what sort of spiritual state they actually are in.

High-level leaders in the CPC have been consistent in their support for construction of the Shuikou hydropower station. CPC Central Committee Secretary Hu Yaobang stated in 1983 that "we must be determined to start this project as soon as possible. Regardless of what aspect we are concerned with, construction one year in advance would provide a year's benefits in advance."

The various preparatory projects related to the Shuikou hydropower station now are proceeding with urgency, and the sound of blasting and trucks rolling along is heard frequently along the banks of the Min Jiang. The scene is one of feverish activity and the Shuikou Power Station construction project that has been so fraught with problems in the past now is on its way to becoming a reality.

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CSO: 4013/109

INTERNATIONAL BIDDING OPENS FOR SHUIKOU CONTRACTS

OW010648 Beijing XINHUA in English 0537 GMT 1 Aug 86

[Text] Beijing, 1 Aug (XINHUA)--International bidding for civil engineering work on China's second-largest hydroelectric power station opened in the Fujian provincial capital of Fuzhou Thursday, today's PEOPLE'S DAILY reported.

"This is the first time China has invited international bids for all civil engineering work on a large hydroelectric station," the paper said.

Ten firms from Britain, China, France, Italy, Japan, West Germany, and Spain sent in bids to compete for the contract on the Shuikou station on the Min Jiang.

The 1.4-million kW station, one of China's key projects during the Seventh Five-Year Plan (1986-90), is now being built with loans extended by the World Bank. When completed in 1993, it will be able to supply five billion kWh a year. "The winner of the bidding will be notified within 2 or 3 months," the paper said.

An official of the Chinese Ministry of Water Resources and Electric Power said he believed that international bidding is an "effective way" to cut costs, shorten the construction period and improve the standards of hydroelectric power stations in China.

/9604
CSO: 4010/69

INITIAL PLANS FOR ERTAN STATION PASS REVIEW

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 3, 12 Mar 86 p 33

[Article by special reporter Zheng Shunwei [6774 7311 3555]: "Preliminary Designs for the Ertan Power Station on the Yalong Jiang in Sichuan Pass Review"]

[Text] From 5 to 12 January 1986, at the behest of the State Planning Commission, the Ministry of Water Resources and Electric Power convened a meeting to review the preliminary design for the Ertan power station on the Yalong Jiang. About 200 representatives from a total of 55 units attended the meeting. They included the State Planning Commission, the Ministry of Urban and Rural Construction and Environmental Protection, the Ministry of Forestry, the Ministry of Machine-Building Industry, the Sichuan Provincial People's Government and related committees and bureaus, Dukou Prefecture, Liangshan Autonomous Prefecture, the Fire Protection Bureau of the Bureau of Public Safety, related research institutes in the Chinese Academy of Sciences, related institutions of higher education, the Harbin Electric Generator Plant, the Dongfang Generator Plant, the Ministry of Water Resources and Electric Power, and other relevant units. The meeting heard a report from the Chengdu Survey and Design Academy concerning the preliminary design for the Ertan power station and held intensive discussions. All of the delegates at the meeting felt that the strong coordination from the related scientific research departments and institutions of higher education had enabled the Chengdu Survey and Design Academy to do a large amount of survey, design, and experimental research work related to the Ertan project over a period of more than 10 years. The geological conditions of the project now are understood, the main technical problems have been solved rather well, the program recommended for the design is economically rational and totally feasible, and encouraging results have been achieved in the area of extending technological progress. For this reason, there was unanimous agreement with this preliminary design report and opinions were offered concerning its review.

The Ertan hydropower station is located on the Yalong Jiang in Laiyi and Yanbian counties in Dukou Prefecture in the western part of Sichuan Province. It is 46 kilometers from Dukou, which lies downstream, and it is a comprehensive utilization key hydropower project centered on power generation. The dam site will control an area of 116,400 square kilometers above it and it has a long-term average flowrate of 1,670 cubic meters per second. The total

reservoir capacity is 6.18 billion cubic meters and the normal water storage level is 1,200 meters (corresponding to a reservoir capacity of 5.8 billion cubic meters). The total installed generator capacity of the power station is 3.00 million kW (six individual generators, each with a capacity of 500,000 kW), guaranteed output of 1.00 million kW and an annual power output of 16.2 billion kWh. It can conserve about 10 million tons of raw coal each year. The project is designed for floods of 20,600 cubic meters per second, which occur at a frequency of once every 1,000 years, and was checked for floods of 25,200 cubic meters per second, which occur with a frequency of once every 10,000 years. The project will involve a concrete spillway dual-arch dam. On the left bank there will be an underground plant building, a water intake system and a log handling facility, while the right bank will have a flood discharge tunnel. The bedrock system at the dam site in the key project is magmatic rock (syenite and basalt), and it is solid and integral. The geological conditions at the project are excellent, and it is suited to the construction of a high arch dam and underground plant building. The dual-arch dam will be 240 meters tall, 763.3 meters long across the top and 70.34 meters thick at the base. The thickness-to-height ratio is 0.293. About 5.30 million cubic meters of concrete will be used. Ertan will have the tallest dam, largest power station and largest underground plant building of any of China's water conservancy and hydropower projects whose design has been approved. The main parts of the project and flow diversion will require clearing 8.73 million cubic meters of rock and soil, digging 4.20 million cubic meters of tunnels and pouring 7.25 million cubic meters of concrete. The reservoir will inundate a total of 24,800 mu of cultivated land and require the resettlement of 28,500 people. The first generator will begin generating power 10 years after preparations for the project begin and completion is expected in the 12th year. Total investments for the project will be about 3.7 billion yuan (compensation paid to those resettled from the reservoir has been estimated at about 250 million yuan). Unit investments per 1,000 kW are about 1,200 yuan and the unit investment per kWh is about 0.23 yuan.

The conference felt that the good geological conditions at the Ertan hydropower station, the large benefits from power generation, the rather small inundation losses and superior kinetic energy economic indices make this a singularly good site for the short-term development of a large scale hydropower station in southwest China. It proposed its inclusion in the Seventh 5-Year Plan and called for its rapid construction so that it can make a contribution to development of the national economy in Sichuan Province as soon as possible.

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HYDROPOWER

LANGYANGXIA TO BEGIN STORING WATER IN OCTOBER 1986

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 4 Jul 86 p 1

[Excerpt] Recently, the State Economic Commission and the Ministry of Water Resources and Electric Power presided over a meeting in Xi'an attended by officials of concerned departments in Shaanxi, Gansu, Qinghai, Ningxia, and Nei Monggol to resolve issues of serious power shortages that will occur during the period is to impounded at the Longyangxia hydropower station's reservoir.

Located in Gonghe County, Qinghai Province, the Longyangxia hydropower station is a major state construction project. The station will have an installed capacity of 1.28 million kilowatts. In October of this year, when the station will lower its gates and begin to store water, the flow of the Huang He will be interrupted for a period of 3 months. The four downstream stations -- Liujiaxia, Yanguoxia, Bapanxia, and Qingtongxia -- will experience a large reduction in generator capacity for a period of 2 years. Today, the main dam of the Longyangxia hydropower station has already risen to a height of 120 meters and according to plan, from October 1986 to mid-February 1987, the reservoir will store from 1 billion to 3 billion cubic meters of water. In this period, in addition to the power shortage to be felt throughout the Northwest Power Grid, there will be reduced amounts of potable water for human and livestock consumption.

During the course of the meeting, responsible comrades from the State Economic Commission and the Ministry of Water Resources and Electric Power requested all provinces and regions to cooperate in handling the temporary difficulties anticipated during the period in which water is being impounded.

CSO: 4013/156

EXPLOITING HUGE HYDROPOWER RESOURCES OF DADU RIVER SYSTEM

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 3, 12 Mar 86 pp 13-17

[Article by Li Yongxin [2621 3057 2450] of the Ministry of Water Resources and Electric Power Chengdu Survey and Design Academy: "Accelerate Development of the Rich Hydropower Resources of the Dadu He--A Brief Introduction to Planning Work on the Dadu He"]

[Text] The Dadu He is one of 10 large hydropower base areas envisaged in Chinese plans. To speed up development of the rich hydropower resources of the Dadu He, the Chengdu Survey and Design Academy completed a planning report for the area between Shuangjiangkou and Tongjiezi on the main trunk in June 1983 which I now will briefly introduce.

I. An Overview of the Dadu He and Achievements in Planning Work

The Dadu He is the largest tributary of the Min Jiang river system in the Chang Jiang basin. It originates on the southern flank of the Guoluo Shan in Qinghai Province and flows into the Min Jiang at Leshan City in Sichuan Province. The river channel is 1,062 kilometers long and its watershed covers 77,400 square kilometers. The Dadu He carries large amounts of water and runoff variations are rather stable. The long-term average annual flowrate in the area of Tongjiezi in the lower reaches is 1,490 cubic meters per second and the average annual runoff is 47 billion cubic meters, which is almost as much as the amount of water flowing in China's Huang He. There is a natural drop of 4,180 meters between the source of the river and its mouth, an average gradient of 0.0033. The section above Shuangjiangkou is usually referred to as the river source region, the section between Shuangjiangkou and Luding as the upper reaches, the section from Luding to Tongjiezi as the middle reaches and the section below Tongjiezi as the lower reaches. The river source and upper reaches are located in western Sichuan plateau terrain, the middle reaches are in mountainous terrain in southwestern Sichuan and the lower reaches are in hilly terrain in the Sichuan Basin. All of the planned river section between Shuangjiangkou and Tongjiezi is high mountains and gorges located in high and medium mountains. The cross-sectional depth of the river gorges generally exceeds 2,000 meters and there are only the two Jinchuan and Hanyuan river valley basins along the river, and the river valleys are rather broad. The trunk and tributaries of the Dadu He contain theoretical hydropower resource reserves of 31.32 million kW, 23.48 million kW of which is

developable and usable. This accounts for about one-fifth of Sichuan and one-eighth of the Chang Jiang basin. The Dadu He is located near the Sichuan Basin. Communications along the river are rather convenient and power supply sites are suitably located. The Gongzui (low dam) power station was built on the trunk after the nation was founded and a group of large, medium, and small power stations like the Nanya He II and III cascade power stations, the Longchi cascade and so on have been built on its tributaries. The total installed generator capacity is about 880,000 kW. The installed generator capacity at the Tongjiezi hydropower station now under construction is 600,000 kW and the plan is for it to be completed and start generating power in 1991.

To develop and utilize the rich hydropower resources of the Dadu He, the Chengdu Survey and Design Academy began a large amount of survey, planning and survey design work for the Dadu He in the 1950's and completed the "Dadu He Plan Report" in June 1983. To permit a matchup between the planning report and its examination and approval, we completed the "Report on Supplementary Arguments on the Dadu He Short-Term Development Project" and the television film "The Dadu He Plan" in June 1984. Comprehensive planning for the development provided the following results: (1) A cascade development program made up of a total 16 cascades predominated by the two regulating reservoirs at Dusong (normal water storage level of 2,310 meters) and Pubugou (normal water storage level of 2,310 meters), total installed generator capacity of 17.6 million kW, guaranteed output of 7.38 million kW and annual power output of 100.8 billion kWh. (2) The river section between Dagangshan and Tongjiezi was selected as the focal point for short-term development. The main cascades in this section would have a total installed generator capacity of 7.50 million kW, guaranteed output of 2.35 million kW and annual power output of 39.2 billion kWh. (3) The Pubugou cascade was recommended as a short-term development project. This power station would have an installed generator capacity of 2.80 million kW, guaranteed output of 880,000 kW and annual power output of 14.2 billion kWh. The locations of the Dadu He cascade power station and a profile of the cascade power stations are shown in Figure 1 and 2 [omitted]. The primary technical and economic indices of each of the cascade power stations are shown in the accompanying Table.

II. The Entire River Was the Basis for Choosing Shuangjiangkou-Tongjiezi as the Planned River Section

On-site surveys and several studies led us to use the entire river as the basis for the decision to make the Shuangjiangkou-Tongjiezi section the planning river section on the Dadu He trunk. The reasons are: (1) Hydropower resources are the most concentrated here. This section of the river is 593 kilometers long and drops more than 1,800 meters. It has theoretical hydropower resource reserves of 17.48 million kW and developable hydropower resource reserves of 17.60 million kW, which are 83 percent and 86.0 percent of the total figures for the trunk of the Dadu He. Good planning in this river section is of major importance for the development of hydropower resources and for electric power construction in Sichuan Province. (2) The development tasks are rather clear. The main task is power generation, followed by floating timber and downstream navigation, flood prevention,

irrigation and other forms of comprehensive utilization. (3) The planned river section includes the Dusong reservoir in the upper reaches and the Pubugou reservoir in the middle reaches. Planning for the Dusong and Pubugou reservoirs with their rather good regulation capabilities can serve as a comprehensive and rational cascade development program for the trunk of the Dadu He.

III. Conscientious Geological Prospecting Work, Selecting the Best Section for a Dam

Although the main dam section on the trunk of the Dadu He is located in a region of hard magmatic rock, the geological structures within the basin are rather complex. According to an understanding gained previously, the main engineering geology factor affecting the selection of cascades and dam sections is the question of the stability of regional structures and the thickness and structure of riverbed capping strata. To investigate this question, 1:50,000 and 1:100,000 scale regional geology maps covering 16,000 square kilometers were prepared for eight of the cascades within the planned river section, including Dusong, Ma'nai, Changhebai, Dagangshan, Longtoushi, Pubugou, Gongzui, and Tongjiezi. We also prepared 1:1,000, 1:2,000, 1:5,000, and 1:10,000 scale geological charts covering 41 square kilometers for the dam region, did more than 70,000 meters of exploratory drilling (including more than 20,000 meters of exploratory drilling in the riverbed capping strata), more than 7,000 meters of exploratory tunnelling, more than 24,000 standard points of geophysical exploration and more than 56,000 cubic meters of pit exploration, and we also carried out the corresponding experiments. Moreover, examination and approval of earthquake intensities at the primary cascades were completed and checked at seven sites, and a seismic monitoring station was set up.

Intensive key exploration and analytical research resulted in the following achievements: (1) With a focus on the stability of regional structures, research on the primary faults within the basin that affect the stability of regional structures, the traces of new structural activity, data on topographical changes and their relationship with the distribution of microtremors and other questions not only permitted an examination of the regional structural background of the planned river section but also a discussion of the regional stability question for each project. The results obtained indicate that the Xianshui He-Moxi fault zone in the northern and southern Sichuan-Yunnan structural zones is the primary area of seismic activity that is responsible for strong earthquakes in Sichuan. The Luding to Shimian section of the Y-shaped zone of convergence and compounding of the Xianshui He-Moxi, Longmen Shan, and Dadu He fractures provides a complex structural background and it is the most obvious river section relative to regional structural stability in the Dadu He basin and has rather large effects on Dagangshan and other cascades. (2) While using exploratory drilling, geophysical prospecting and other comprehensive measures to investigate the thickness and structure of the riverbed capping strata, new structural activity and Quaternary geology were used as the foundation for research concerning the formational laws of the various different structural

positions. The results indicate a structurally-controlled fault-subsidence basin, a structurally adaptive basin and an intermontane river valley basin. The capping strata generally are 80 to 130 meters thick and the structures are rather complex. The riverbed capping strata in the river sections that still are in an uplifted state in the modern era (like Dagangshan) are only 10 to 20 meters thick and structurally simple. Based on the above results, it was proposed that river sections with moderately thick riverbed capping strata be the primary river sections to be developed and utilized on the Dadu He. (3) As for Dusong, Pubugou, and other controlling cascades, comparison of several dam sections permitted the selection of river sections with the best engineering geology conditions. There also was an investigation of the regional structural background in the Dagangshan cascade and a discussion of the possibility of installing a dam and the height to which the dam could be built. Preliminary investigations also have been made into engineering geology questions of the other main cascades.

IV. Based on Natural Conditions and the Characteristics of Hydropower Resources, the Recommendation Is a Cascade Development Program Using the Dusong Low Program and the Pubugou High Program

More than 30 surveys and investigations were carried out in the planned river section to study the river basin cascade programs. The following points were the main considerations during the process of studying the cascade programs: (1) Most of the existing and planned hydropower stations in the Sichuan power system are of the runoff type or have rather poor regulation capabilities. There are major differentials in output between the wet and dry seasons, so consideration must be given to the possibility of utilizing the rather large terrain-formed reservoirs in the upper reaches at Jinchuan and in the middle reaches in the Hanyuan Basin. (2) The geological conditions within the basin are rather complex, and dam selection and cascade arrangement often are subject to control by geological factors. As a result, great efforts should be made to have them correspond to geological conditions and the level of technical development. (3) The planned cascade program should strive for rather substantial comprehensive utilization results. Based on the above principles we focused first of all on reservoirs in the upper and middle reaches during cascade planning.

For the reservoir in the upper reaches located downstream from Jinchuan, comparisons were made of the four dam sections at Dusong, Anning, 215 Maintenance Team, and Ma'nai and key exploration was done at Dusong and Ma'nai. The results indicate that the regional structures in the Dusong dam section are stable, earthquake intensity is grade VI, the riverbed capping strata are relatively thin and the structures are fairly simple, so it has the conditions for construction of a high dam. For this reason, Dusong was selected as the reservoir cascade in the upper reaches. The Dusong cascade is based on the need to form the Longtou reservoir with its rather good regulating capabilities. There are high and low programs. In the low program, the normal water storage level is 2,310 meters and the total reservoir capacity is 5.0 billion cubic meters and year-round regulation is not possible. The high program has a normal water storage level of 2,360 meters

and the total reservoir capacity is 8.0 billion cubic meters. It can be regulated over a period of many years. In the high program, however, the rock-fill dam would be about 290 meters high, far in excess of current world standards for building a dam on a soft foundation, so the low program has been selected temporarily.

The reservoir in the middle reaches is located downstream from Hanyuan. In nine dam sections above, in and below Yangsiying, Guandituo, Dazhima, Zhaohoumiao, Shunhexiang, Jiaotuo, and Pubugou, the plan focused on studying two dam sections above and in Beibugou with relatively good conditions for dam construction and kinetic energy economic indices. The results indicate that the regional stability is rather good, the earthquake intensity is grade VII, the riverbed capping strata are about 70 meters thick, it is structurally simple and it has the conditions for construction of a high dam and large reservoir. Because of the confluence of the tributary Niuri He, the dam sections above and in Pubugou have their advantages and disadvantages in terms of terrain, geology, hydrology, changes in railway lines and kinetic energy economic indices and other aspects, so the dam section in Pubugou will serve temporarily as the representative dam section for the cascade plan. The Pubugou cascade will require the flooding of Hanyuan City and the farmland around it before a reservoir of great capacity can be built. The plan compared high and low programs to deal with the important question of flooding the town and farmland of Hanyuan City. The high program has a normal water storage level of 850 meters, a total reservoir capacity of 5.25 billion cubic meters and an effective reservoir capacity of 3.87 billion cubic meters. It would not be capable of year-round regulation. The total installed generator capacity would be 2.80 million kW, the amount of cultivated land flooded would be 32,000 mu and 58,000 people would have to be resettled. The low program has a normal water storage level of 750 meters, a total reservoir capacity of 100 million cubic meters and an effective reservoir capacity of 20 million cubic meters. It would have a very poor regulation capacity. The total installed generator capacity would be 900,000 kW, the amount of cultivated land flooded would be 1,100 mu and 1,600 people would have to be resettled. After debate and comparison, it has been decided that the benefits of the high program far exceed the losses caused by flooding. After a comprehensive comparison of the advantages and disadvantages of the high and low programs, the high program was selected.

The layout of cascades on the Dadu He as a whole is dominated by the controlling cascades at Dusong and Pubugou, and four programs were considered: (I) A program dominated by the high program at Dusong and a high program at Pubugou, with a total of 16 cascades and an installed generator capacity of 18.00 million kW; (II) a program dominated by a low program at Dusong and a high program at Pubugou, with a total of 16 cascades and an installed generator capacity of 17.60 million kW; (III) a program dominated by a high program at Dusong and a low program at Pubugou, with a total of 17 cascades and an installed generator capacity of 16.50 million kW; and (IV) a program dominated by a low program at Dusong and a low program at Pubugou, with a total of 17 cascades and an installed generator capacity of 16.10 million kW.

After the comparisons outlined above, it was decided to recommend program II. The main reasons for this were: (1) The energy indices and unit indices were better and guaranteed output of the cascade would be 1.00 million kW higher than in program III, while better comprehensive utilization and silt control results would be achieved than in programs III and IV. (2) The high program for Pubugou is a project on the Dadu He that has relatively good short-term development conditions and is more realistic in the area of construction conditions than the other programs. (3) Although the unit inundation indices were larger than for programs III and IV, the amount of cultivated land flooded per 10,000 kW in installed generator capacity would be two-thirds lower than on the Hongshui He, while the number of people resettled also would be one-half less, so the unit inundation indices still are relatively low.

V. After Comprehensive Debate, Pubugou Was Recommended as a Short-Term Development Project

After the studies, the section of the Dadu He between Dagangshan and Tongjiezi was recommended as the focal river section for short-term development because of the convenient communications, suitable geographic location, the substantial amount work done there and good construction conditions. The projects that can be developed in this river cascade in the short-term include adding height to the Gongzui [dam], Pubugou, Dagangshan, and Longtoushi. Adding height to Gongzui would involve the continuation of a construction project for an additional 1.40 million kW in installed generator capacity, something that is technically feasible and economically beneficial. It is predicted that coarse silt will accumulate at the low dam power station that already has been built up to the front of the dam by 1993 and that suspended silt will fill it up by 1995. There is an objective need for urgent continued construction but there is a problem related to power shutoffs during the height-adding process, so it would be hard to achieve in the short run. For this reason, comparisons for short-term possibilities in development projects included Pubugou, Dagangshan, and Longtoushi, which were then combined into three programs: (1) Pubugou, with an installed generator capacity of 2.80 million kW; (2) Dagangshan and Longtoushi, with an installed generator capacity of 2.00 million kW; and (3) Dagangshan, with an installed generator capacity of 1.50 million kW.

After debate and comparison, Pubugou was recommended as the short-term development project for the Dadu He. The reasons are: (1) The power station has a suitable geographic location and an installed generator capacity of 2.80 million kW. It is capable of regulation for part of the year and is a hydropower station that has rather good regulation capabilities and a rather large scale. Besides being able to increase guaranteed output at the Gongzui (low program) and Tongjiezi hydropower stations by 240,000 kW and annual power output by 900 million kWh, it also would lead to rather good improvements in the operating conditions of the Sichuan power network. (2) The reservoir would control 80 to 90 percent of the silt carried in the Dadu He and have an accumulation lifetime of more than 150 years, which would play an obvious role in improvement of silt accumulation problems in the Gongzui and Tongjiezi reservoirs. In addition, the Pubugou reservoir also would have certain

Table 1. Technical Economic Indices for the Cascade Development Program on the Dadu He

Item		Duaong	Ma'nai	Jijiaheba	Houziyan	Changheba	Lengzhuguan	Luding	Yingliangdao
Distance from river mouth (km)		585	550	493	448	423	395	377	339
Area of drainage basin (km^2)		41,284	42,382	53,100	54,968	56,545	58,675	58,943	58,943
Long-term average annual flowrate (m^3/sec)		531	550	727	778	815	890	890	890
Normal water storage level (m)		2,310	2,092	2,040	1,800	1,630	1,475	1,370	1,250
Total reservoir capacity (100 million m^3)		49.6	1.7	20.0		6.0	6.2	2.8	
Effective reservoir capacity (100 million m^3)		26.8	0.2						
Design floodwater flowrate (m^3/sec)		6,700	5,960	7,350	7,520	7,710	8,140	6,800	8,140
Checked floodwater flowrate (m^3/sec)		8,710	8,280	9,380	9,580	9,840	10,400	8,670	10,400
Safe dam floodwater flowrate (m^3/sec)		9,460		10,200	10,400	10,700	11,300	9,770	11,300
Usable drop (m)		218	52	240	170	155	105	70	120
Guaranteed output	Independent operation (10,000 kW)	50	5.3	34.8	27.1	25.5	18.5	12.3	21.4
	Joint operation with full cascade (10,000 kW)	53.2	13.9	78.6	58.2	53.2	39.3	26.1	43.9
Installed capacity (10,000 kW)		136	30	180	140	124	90	60	110
Average yearly power output	Independent operation (100 million kWh)	68.4	16	95.8	73.9	68	49.1	32.8	58.3
	Joint operation with full cascade (100 million kWh)	70.1	18.1	109.6	83.5	76.2	55.4	36.9	65.5
Utilization time	Independent operation (hrs)	5,030	5,140	5,320	5,280	5,450	5,460	5,470	5,300
	Joint operation with full cascade (hrs)	5,150	6,030	6,090	5,960	6,150	6,160	6,150	5,950
Flowrate diverted for power generation (m^3/sec)		1,028	788			1,160			
Reservoir inundation	Cultivated land (mu)	11,370	2,851	12,370	995	105	2,575	810	3,060
	Population (individuals)	15,255	1,616	24,358	601	57	5,394	180	1,500
Dam type		Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill	Rock-fill
Max. dam height (m)		236	65	276	200	180	122	86	160
Geology of dam site		Granite	Granite	Granite	Granite	Granite	Granite	Diorite	Diorite
Max. thickness of riverbed capping strata (m)		80	126			>68			
Basic earthquake intensity (grade)		VI	VI	VI	VII	VII	VIII	VIII	IX
Total investment (100 million yuan)		32.7	6.0	42.1	23.8	20.3	16.2	12.6	19.8
Investments per unit installed capacity (yuan per kW)		2,404	2,000	2,339	1,700	1,637	1,800	2,100	1,800
Construction time (including preparation)	Power output of first generator (years, months)					7			
	Total construction time (years, months)	14	6			9			

(Continued)

Table 1. Technical Economic Indices for the Cascade Development Program on the Dadu He

Item \ Name of Cascade		Dagangshan	Longtoushi	Longyingyan	Pubugou	Shenxigou	Zhentouba	Gongzui	Tongjiezi	Total
Distance from river mouth (km)		307	291	274	194	180	160	91	58	
Area of drainage basin (km^2)		62,727	62,727	64,810	72,653	72,653	72,653	76,130	76,400	
Long-term average annual flowrate (m^3/sec)		1,060	1,060	1,130	1,340	1,340	1,340	1,490	1,490	
Normal water storage level (m)		1,100	955	905	850	650	623	590	474	
Total reservoir capacity (100 million m^3)		4.5	1.2		52.5			18.8	2.0	
Effective reservoir capacity (100 million m^3)		1.5	0.2		38.7			8.2	0.54	
Design floodwater flowrate (m^3/sec)		8,380	8,000	8,520	10,600	8,500	8,500	13,800	13,800	
Checked floodwater flowrate (m^3/sec)		11,200	10,700	9,960	13,300	10,100	10,100	16,400	16,400	
Safe dam floodwater flowrate (m^3/sec)					14,500					
Usable drop (m)		145	50	50	179	27	33	116	41	1,771
Guaranteed output	Independent operation (10,000 kW)	34.3	11.4	12.7	88.2	7.9	9.7	43.2	13.0	415.3
	Joint operation with full cascade (10,000 kW)	59.4	23.2	23.3	105.5	19.4	23.7	83.4	33.2	737.5
Installed capacity (10,000 kW)		150	50	60	280	36	44	210	60	1,760
Average yearly power output	Independent operation (100 million kWh)	81.2	28.0	31.9	141.5	19.8	24.1	101.0	32.1	921.9
	Joint operation with full cascade (100 million kWh)	89.7	31.3	35.0	142.8	23.4	28.7	104.8	37.1	1,008.1
Utilization time	Independent operation (hrs)	5,410	5,580	5,320	5,050	5,500	5,480	4,810	5,350	5,238
	Joint operation with full cascade (hrs)	5,980	6,260	5,830	5,100	6,500	6,520	4,990	6,180	5,728
Flowrate diverted for power generation (m^3/sec)		1,516	1,385		2,352			2,470		
Reservoir inundation	Cultivated land (mu)	974	477	2,510	31,851	None	None	11,006	4,304	85,258
	Population (individuals)	506	639	4,172	57,637	None	None	27,617	5,886	145,418
Dam type		Concrete gravity	Rock-fill	Rock-fill	Rock-fill	Concrete sluice	Concrete sluice	Concrete gravity	Concrete gravity	
Max. dam height (m)		175	63	72	195			146	76	
Geology of dam site		Granite	Granite	Granite	Granite and rhyolite-porphyry	Limestone	Basalt	Granite	Basalt	
Max. thickness of riverbed capping strata (m)		14.2	68		63			40~70	30~70	
Basic earthquake intensity (grade)		VIII	VIII	VIII	VII	VII	VII	VIII	VII	
Total investment (100 million yuan)		18.3	6.8	9.2	30.5	6.2	7.5	20.7	11.5	284.2
Investments per unit installed capacity (yuan per kW)		1,220	1,360	1,533	1,089	1,722	1,705	986	1,917	1,615
Construction time (including preparation)	Power output of first generator (years, months)	10	6		10/10			(7)	10	
	Total construction time (years, months)	11/6	8		13			(8)	11	

benefits for downstream navigation, flood prevention and so on. (3) The main problem is the rather substantial inundation losses for the reservoir, but in comparison with Baozhusi, Dongjiang, Shuikou, Wuqiang Xi, and other power stations that are under construction or are to be built, the unit inundation indices still are rather low.

VI. Some Points of Knowledge

1. Correct deployment of geological prospecting work during the planning stage is the foundation for good river basin planning. The geological conditions of the Dadu He are rather complex, so the Chengdu Academy made rather comprehensive deployments of geological prospecting work during the planning stage to assure that the plan is built on a reliable foundation. We were concerned with the need for a focus in our work and strove to reduce the amount of work wherever possible, and we applied and made use of various different prospecting measures. During 5 years of prospecting work, we not only gained an understanding of the laws of topographical forms, geological structures, structural activities, seismic activities and so on, but we made theoretical explorations of the formation and utilization of riverbed capping strata, demarcation, and utilization of stable land masses and other questions, and on this foundation we focused on research, development, and utilization of the river section and selected dam sections with favorable topographical and geological conditions.

2. A correct guiding ideology for planning was the prerequisite for good river basin planning. The Dadu He plan proposed an emphasis on power generation and gave secondary consideration to floating timber, downstream navigation, flood prevention, irrigation, and other comprehensive development tasks. To meet the demands involved in the tasks outlined above, we should do everything possible to build reservoirs with regulation capabilities, so the focus of the plan was determined to be the two reservoir cascades at Dusong in the upper reaches and Pubugou in the middle reaches. This provided a rather clear guiding ideology for selection of planning river sections, cascade program deployment and comparison and other aspects.

3. Comprehensive debate and widespread gathering of opinions are an important route to correct selection of short-term development projects. Correct selection of short-term development projects first of all requires a large amount of kinetic energy economic calculations concerning projects with short-term development possibilities and integration with the characteristics of the Sichuan electric power systems so that the recommended Pubugou hydropower station would have a fairly reliable basis in technical economic arguments. In another area, frequent and widespread solicitation of ideas from all areas during the later planning stages unified understanding of the Dadu He plan and aspects related to the short term.

4. Attention by the leadership and local support are important conditions for good river basin planning. All levels of leadership in the ministry, central bureau, and planning academies as well as the Chengdu Academy paid close attention during the planning work for the Dadu He. They listened to many reports and made on-site investigations to develop concrete indices and arrangements for the planning work as a whole. The relevant departments in Sichuan Province also provided effective support. All of this created extremely favorable conditions for easy completion of the Dadu He plan.

12,539/9599
CSO: 4013/105

FIVE 1000MW PLANTS TO BE BUILT IN EAST CHINA

Shanghai JIEFANG RIBAO in Chinese 23 Mar 86 p 1

[Article: "East China Will Build Five 1000MW Power Plants--The Central Government and Local Areas Join Forces To Develop Power Grids During the Seventh Five-Year Plan--Jiangsu, Zhejiang and Anhui Provinces and Shanghai Municipality Will Raise 4 Billion Yuan"]

[Text] Raising capital to develop power has become a strategic measure in the East China Grid to deal with the power shortage. During the Seventh Five-Year Plan, Jiangsu, Zhejiang and Anhui Provinces and Shanghai Municipality will raise more than 4 billion yuan in capital to develop electric power. Added to state investments in power in this region, the East China Grid will strive to add more than 10 million kW in additional installed generator capacity. Achievement of this goal would be roughly three times the 3.4 million kW in installed generator capacity added during the Sixth Five-Year Plan.

The East China Grid is China's largest grid that crosses provincial and municipal boundaries, and the region also has the most serious power shortage. During the Sixth Five-Year Plan, Jiangsu and Zhejiang Provinces and Shanghai Municipality raised over 380 million yuan to add more than 330,000 kW in installed generator capacity at the Jianbi, Taizhou, and Minhang power plants. During the Seventh Five-Year Plan, the three provinces and one municipality in the East China Grid will use multiple channels to raise nearly 4 billion yuan in capital for electric power construction to add more than 4 million kW in electric power. Shanghai, which has a serious power shortage, is quite enthusiastic about raising capital and will raise nearly 1 billion yuan over the 5-year period. The new 1200MW Shidongkou No 2 power plant will be built, and the Wujing, Minhang, and other power plants will be expanded. Jiangsu Province has raised the most capital, a total of more than 1.4 billion yuan, and is striving to add more than 1.8 million kW in installed generating capacity.

Central and local investments during the Seventh Five-Year Plan to build large-scale power plant projects are to be used mainly for "harbor power plants" at load centers along the coast and the Chang Jiang as well as for "pit-mouth power plants" in coal producing areas. Construction of the four 300,000 kW generator sets at the Shidongkou No 1 power plant built with state investments began in 1985 and they are striving to place all of them into production before 1990. In addition, there is hope that the first of the two 600,000 kW generators at the Shidongkou No 2 power plant built with investments raised by

Shanghai also will go into operation. The Jianbi power plant, now the largest in the East China Grid in terms of capacity, is adding two 300,000 kW generators. Foreign capital is being used for construction of the 700,000 kW Tianshenggang power plant at Nantong in Jiangsu Province and the 1.2 million kW Beicang power plant in Zhejiang Province. The Pingwei Power Plant in Huainan where construction began in the 1980's will add the first two 600,000 kW Chinese-produced generators in East China during the Seventh Five-Year Plan. By the end of the Seventh Five-Year Plan, the number of large scale power plants in excess of 1 million kW capacity will be increased from the current single plant at Jianbi to six at Jiangbi, Xuzhou, Wangting, Pingwei, Zhenhai, and Shidongkou.

In addition, the three 500 kV high tension power transmission lines running from Huainan to Shanghai, from Xuzhou to Shanghai and from Gezhouba to Shanghai will be completed and go into operation during the Seventh Five-Year Plan. China's first nuclear power station, the 300MW Qinshan nuclear power station, and the Zhejiang Jinshuitan hydropower station may be completed and go into operation before 1990.

Wang Lin [3769 2651], director of the State Council's Shanghai Economic Region Planning Office and leader of the East China Grid Leadership Group has stressed that although electric power is receiving the greatest investments and the largest scale in the three provinces and one municipality during the Seventh Five-Year Plan, it still will be difficult to alleviate the serious power shortages in the region. For this reason, local areas, departments and enterprises will continue to receive encouragement to expand channels for raising capital to develop electric power and focus on planned power use and conservation.

12539/5915
CSO: 4013/109

BRIEFS

NEI MONGGOL 800MW PLANT--On 1 July, the autonomous region broke ground for the Fengzhen power plant, one of the key projects set forth by th State's Seventh 5-Year Plan. The power plant is a large electrical energy resource center designed and to be built and managed by the region itself. The construction consists of setting up four generating units with a capacity of 800,000 kW The first 200,000-kW generating unit will be put into operation between the end of 1988 and the beginning of 1989. After completing the construction of the project in 1991, the plant will not only saturate the supply demand of western Nei Monggol, but will also supply power to the cities of Beijing, Tianjin, and Tangshan, as well as become the key power plant of the Hu-Bao grid, which will supply power to the Huabei grid. /Excerpt/ /Hohhot Nei Monggol Regional Service in Mandarin 1000 GMT 1 Jul 86 SK/ 12228

CSO: 4013/145

PLANS TO MODERNIZE MINES IN SEVENTH FIVE-YEAR PLAN OUTLINED

Beijing ZHONGGUO MEITAN BAO in Chinese 26 Feb 86 p 1

[Article: "Ministry of Coal Industry Decides To Construct a Group of Uniquely Chinese Modern Coal Mines During Seventh Five-Year Plan; Decision Points out That Optimum Sites Should be Selected, Construction Should Be Done According to High Standards"]

[Text] The Ministry of Coal Industry made a decision on 5 February to build a group of modern mines. The CPC Group in the Ministry pointed out that efforts will be made during the Seventh Five-Year Plan to build one-third of China's unified distribution mines into modernized mines and lay a good foundation for turning two-thirds of the unified distribution mines into modernized mines by the end of this century. A policy of strategic significance, this will encourage the coal industry to make comprehensive improvements in mining technologies and improve economic result to bring China's coal industry into the advanced ranks of the world by the end of this century and to guarantee completion of the magnificent strategic goal of quadrupling the gross value of industrial and agricultural output in China by the end of this century.

The decision points out that it is possible to start now to build a group of modern mines because we already have nearly 3 years experience in building modern mines. Of the nearly 600 unified distribution mines, one-third of the better ones have the basic conditions for construction of modern mines. Moreover, the implementation of comprehensive contractual responsibility has meant that some bureaus and mines gradually have increased their economic capacity for self-transformation, and our scientific research and manufacturing have a certain capacity to provide the technical equipment needed for modern mine construction. The only thing that is needed is for coal offices and mine bureaus in all provinces to strengthen leadership and treat construction of modern mines as a major item. In this way, it is entirely possible that a few years of key construction could raise some mines up to modern mining standards.

What sort of modern mines are to be constructed? The decision points out:

We must build modern mines that are Chinese and socialist in character. We must achieve good safety, fewere employees, high efficiency, good economic

results, correct mine working styles, good employee living standards and a joint focus on the two types of civilization [material and spiritual]. The guiding ideology should emphasize high standards and focus on high standards of mechanization.

Modernization cannot be treated as generalization. Production should be carried out using advanced equipment and technologies, and we should use modern technical measures to monitor and guide production and use modern management measures to organize production. There also must be obvious improvements in cultural and material life. Employees must be taught to dare to reform and be bold in creating, to love their jobs and to love the mine like their families. They must strive to study scientific and cultural knowledge, observe discipline and respect the law, be concerned with employee ethics, voluntarily control improper working styles and build up ranks that have ideals, ethics, education, and discipline.

Construction of modern mines requires selection of optimum locations according to high standards and seeking truth from facts to build up as many as appropriate. Bureaus with better conditions like Lu'an, Jincheng, Datong, Pingdingshan, Kailuan, Yanzhou and so on should strive to do more and construct modern mining regions.

The various bureaus and mines mainly should depend on their own efforts, take action to exploit potential, make full use of the capital owned by mining bureaus and select the best to guarantee the need for construction of modern mines. The capital owned by provincial coal offices and companies that is collected for use also should select the best programs to guarantee the needs of modern mine construction in their own provinces.

All transformation and expansion projects chosen for building modern mines and newly constructed mines with the proper conditions should revise designs according to modern mining standards and carry out construction to guarantee that they will be able to attain the standard of modern mines after they go into production.

To built up stronger leadership in modern mines, the Ministry of Coal Industry has set up a construction leadership group for modern mines with Vice Minister Hu Fuguo [5170 1381 0948] as chairman, and there is a subsidiary office. The coal departments, companies, mining bureaus, and mines in all provinces should set up corresponding leadership groups.

During construction of modern mines, each of the companies and bureaus in the ministry will have a clear division of labor that will make actual arrangements for the pace of construction for modern mine construction during 1986.

12539/6662
CSO: 4013/102

COAL

ECONOMIC RESULTS STRESSED IN MINE CONSTRUCTION

OW121114 Beijing XINHUA Domestic Service in Chinese 1312 GMT 11 Jun 86

/Report by correspondent Lu Bin/

/Excerpts/ Beijing, 11 Jun (XINHUA)--Following the beginning of the Seventh 5-Year Plan, the nation's coal mines have become more conscious of investment results. Construction project work is faster and the time taken has become shorter.

Construction of 108 coal pits is now going smoothly in various parts of the country. During the first 4 months, 15 major mining districts' invesment in their construction projects was 8.4 percent higher than the same period last year. Their tunnel footage plans were also overfulfilled. Such major coal mines as the Kailuan coal mine in Hebei, the Gujiao coal mine in Shanxi, the Tiefa coal mine in Liaoning, and the Pingdingshan coal mine in Henan all achieved simultaneous investment growth and tunnel footage--a major objective in achieving better economic results from investment. The monthly tunneling footage achieved by the Yanzishan coal mine in Datong, Shanxi, and by the Donghai coal mine in Yizhou, Shandong, both exceeded 800 meters, or one-third more than that of a year before. Construction in other coal mines has also been expedited. The present progress shows that all the 24 coal pits expected to be commissioned this year will begin production as scheduled.

During the Seventh 5-Year Plan, the state will invest a total of 31.5 billion yuan, or 67 percent more than the 18.8 billion yuan of the previous 5-year period, in construction of proejcts to increase coal output by 167 million metric tons from a potential capacity of 180 million metric tons /a year/. The size of construttion was unprecedented in China's coal industry.

Although coal industry investment in construction during the next 5 years will be a record high, the financial and material resources available will still be inadequate for the needs of the coal mines under construction owing to the many projects started during the past 2 yars. Upon deliberating whether to divide financial resources, or whether to ensure the construction of key projects, the Ministry of Coal Industry estimates that 5 years are needed to build coal pits with a production capacity of 100 million metric tons of coal, but only 4 years are needed if the same amount of money is spent to increase output by 80 million metric tons. Having realized this, the ministry promptly decided that no new coal mines will be built this year, and projects that have started will be curtailed so as to ensure adequate resources for the key projects.

/12228
CSO: 4013/145

COAL

CONSOLIDATING, DEVELOPING COAL SUPPLY, DEMAND

Beijing WUZI GUANLI [MATERIAL MANAGEMENT] in Chinese No 2, 20 Feb 86 pp 8-10

[Article by Li Guangchun [2621 1639 2504] of the Fuels Bureau of the State Materials Bureau: "Consolidate and Develop the Present Excellent Situation in Coal Supply and Demand"]

[Text] China has had major shortages in coal supplies for a long time. Coal and power shortages at the end of 1981 and early 1982 caused shutdowns and partial shutdowns in many enterprises that even included some key enterprises. Improvements in this shortage situation began in 1983. Since 1985, there has been a tendency toward alleviation of the contradiction between coal supply and demand and a buyers' market has started to appear in some regions.

I. The Main Characteristics of the Current Situation of Coal Supply and Demand

1. There are sufficient energy resources. In 1986 orders for unified distribution coal in China, the resource adequacies mean not only that users can place orders for coal according to plans but also that some departments and coal-short provinces and municipalities also can place orders in excess of plans. Some coal producing provinces are hoping that the state will purchase more and ship out more. Some mining regions are experiencing difficulties in selling and shipping coal.

2. Reserves have increased substantially. Coal reserves in 1981 were the lowest since 1978 and some provinces and municipalities were unable to maintain normal cycles. At the end of 1981, coal reserves were equivalent to the amount turned around in 1.4 months but the turnaround amount in 1984 was 1.7 months. It has been predicted that the turnaround amount will increase to about 2 months by the end of 1985. The increase in coal reserves has been greatest in key departments and major cities.

3. Poor quality coal has lost its market competitiveness and is selling slowly. There also are problems for bad and low quality coal varieties in unified distribution mines. Some mines have been forced to reduce output.

Many local coal mines have been unable to sell because of poor quality and high prices and serious overstocks.

4. Coal that undergoes market regulation has increased, prices have stabilized or dropped and a tendency for local coal mines to compete with unified distribution mines has appeared. The highest price for delivered coal outside of plans during 1984 in some coastal cities reached 180 yuan per ton but has dropped gradually in 1985 to 90-plus yuan. The Shanghai Municipal Fuel Trade Company organized resources outside plans to participate in market regulation, with the result that the price differential of identical coal types within and outside of plans dropped gradually from 60-plus yuan per ton to 40-plus yuan. After unified distribution coal mines implemented a 50-percent higher price for increased output, a 100-percent higher price for over-quota output and a 10-yuan-per-ton higher price for coal shipped in excess of quotas for railroads in 1985, a situation arose in which many users felt that the use of higher-priced coal from unified distribution mines was not as convenient as coal subject to market regulation, which in addition to quality, shipping and other factors caused some users to compete for local coal at ordering meetings and not to want unified distribution coal. They competed for coal from their own provinces and did not want coal from other provinces. They competed for high quality coal and did not wan low quality coal. A situation came about in which local mines competed with unified distribution mines.

II. The Reasons for the Improvement in Coal Supplies

1. The state adopted correct principles and policies and positive measures to encourage coal mines to increase output. At the beginning of the Sixth Five-Year Plan, coal output in China fluctuated around the 620 million ton level. In 1981, the State Council proposed a principle for dealing with the energy problem that combined development with conservation, and it implemented a policy of deregulation and invigoration for coal enterprises. In 1983, it formulated eight measures for active development assistance for local coal mines. In 1985, it also implemented programs for comprehensive contractual resonsibility for input and output in unified distribution mines as well as a series of principles and policies such as higher prices for coal produced in excess of output or shipping quotas. Coal quality improved quickly. Raw coal output reached 789 million tons in 1984, up by 27 percent over 1980, a 6.2 percent yearly rate of increase. The estimate for 1985 exceeds 830 million tons, with local mines accounting for more than half. Township and town as well as handicraft small coal mines grew even faster, up by an average of 18.4 percent per year between 1980 and 1984. It is possible that they may produce 200 million tons or about one-fourth of total output by the end of 1985.

2. "Single account" reforms were implemented.

Beginning in 1984, single accounts were kept for the production, transport, and distribution of unified distribution coal, which permitted rather good

linkages between coal production, transport, and demand and reduced the contradiction [between supply and demand]. This means that state directive-type distribution plans are first-grade and that their completion must be guaranteed. Some cooperative coal organized by local areas themselves has been made second-grade for inclusion in guidance-type transport plans and coal mines, railways and waterways must work to complete these plans. Implementation of the single account method guaranteed key areas, alleviated a large problem and also took into consideration the development of local industries.

3. Circulation channels were deregulated and coal markets were invigorated.

After coal production and circulation were deregulated and stimulated, a coal market with multiple channels and fewer links appeared. This was especially true after deregulation of non-state unified distribution coal dependent mainly on market regulation as coal markets assumed a tendency toward invigoration. Examples include some local coal from Sichuan and Guizhou supplied to Hubei, Guangdong and Guangxi, local coal from Fujian and Anhui supplied to the Jiangsu and Zhejiang region, coal from Gansu and Yunnan moving into the interior and so on.

4. Communications and transport conditions were improved.

The state has reinforced communications construction and readjusted economic policies over the past 2 years. With the added efforts of communications departments and local areas, all transport potential is being exploited and there has been a large increase in coal transport capacity. There was a 4.4 percent average annual increase in railroad coal shipments from 1980 to 1985, which was higher than the 3 percent yearly rate of growth during the Sixth Five-Year Plan. It has been predicted that Shanxi will ship out 124 million tons of coal in 1985, up by more than 50 million tons over 1980 and a 12.1 percent yearly rate of increase. There also has been a large increase in the coal handling capabilities in coastal harbor. Comprehensive and rational organization of rail, highway and water transport has alleviated the condition of insufficient transport capacity.

5. All coal-using enterprises have focused on economic results, lowering [energy] consumption, conservation and using less coal.

The yearly rate of growth in industrial value of output from 1981 to 1984 was 9 percent, but coal consumption grew by only 5.2 percent per year over the same period. Coal consumption in industrial enterprises under ownership by the whole people grew by 5.4 percent in the first half of 1985 compared with the same period in 1984. This was lower than the 15.9 percent increase in industrial value of output. There have been yearly declines in the amount of coal that must be consumed to produce 10,000 yuan in value of output. There was a yearly decline of 3 percent in 1984 compraed with 1981, and the prediction for 1985 is that it will be down around 9 percent from 1984. Unit consumption for products that consume large amounts of coal has

declined. The standard for coal consumption for power generation in 6,000 kW and above thermal generators throughout China fell by 42 grams [per kWh] between 1980 and 1984, a yearly drop that averaged 2.5 percent. The unit coal consumption standards in key enterprises making cement ripeners, plate glass, synthetic ammonia, viscous fibers (long and short silk) and other products were down by 0.25 to 13.4 percent in the first half of 1985 compared with 1984.

In addition, the proportion of value of output produced by heavy industry has declined over the past 2 years while that of light industry has risen. Small chemical fertilizer enterprises and other large coal consumers have been shut down or converted, which has reduced coal consumption. Moreover, unified distribution mines implemented higher prices for coal produced and shipped in excess of quotas, and some areas have raised coal prices, which has stimulated coal production and also controlled consumption to a certain extent.

III. The Main Problems in Coal Supply and Demand

In a situation of a trend toward alleviation of the contradiction between coal supply and demand, several problems remain to be resolved.

1. The quality problem

One aspect is the higher proportion of poor quality coal. Raw coal output grew by 27.3 percent between 1980 and 1984, but poor quality coal increased by 59.7 percent. Poor quality coal as a proportion of total output rose from 2.9 percent in 1980 to 3.5 percent in 1984. Another aspect is that the quality of coal from certain coal mines does not meet the stipulated standards. The ash content of coal from some unified distribution mines is 60 or higher. According to reports, the high ash content of block anthracite supplied for use in chemical fertilizer production meant that losses resulting from the flying up of mixed coal carried in railway cars was as high as 14 percent. A substantial portion of current coal reserves is made up of low quality coal that is of poor quality, expensive and impossible to sell, whcih is causing administrative problems by tying up circulating capital. According to reports, more than 10,000 tons of Huolin He lignite stored in a certain county in Jilin Province underwent spontaneous combustion and a fire-fighting brigade spent several days putting out the fire.

2. The transport problem

Although there have been major improvements in the transport situation, there are needs that are not being met in two main areas. The first is bottlenecks caused by inadequate freight capacity on the main railways running into eastern China and other areas. The second is that the loading capacity of the main harbors in northern China is not adapted to the unloading capacity of the more than ten coal-handling harbors in southern China.

3. The price problem

Administration of coal prices is rather disorganized as well as very complex at present. Certain coal mines have raised prices and imposed additional fees on their own. Users are quite upset by this.

IV. An Excellent Situation for Consolidating and Developing Coal Supply and Demand

The excellent situation of an alleviation of the contradiction between coal supply and demand at the present time was not achieved easily, and it must be further consolidated and developed. We must take note that the alleviation of the contradiction between coal supply and demand is not a final solution to the energy problem. The amount of coal available per capita in China at the end of the 20th Century will be less than 1 ton, which is much lower than levels in the developed nations. China's long-term supplies of coal will not be abundant. To achieve additional deregulation, invigoration and management of coal production and circulation and to meet the demand for national economic development and the people's livelihood, we feel that a focus should be placed on work in the following areas now and in the future.

1. We must maintain stability in plans.

Coal plays an important role in the national economy and the people's livelihood. Coal production is restricted by geological and developmental conditions, and demand also is subject to restrictions of transport flows, coal types, and quality. The result is that coal production, supply channels, cooperative relationships, communications and transport must remain stable and cannot undergo major fluctuation. The production, distribution, and transport of unified distribution coal should be primarily under control by directive-type plans with a smaller amount under guidance-type plans.

2. Most local non-unified distribution coal should be sold on the market.

The state should adopt measures to strengthen macroeconomic management of production and sales activities for this coal. We cannot allow uncontrolled movement and must achieve comprehensive equilibrium in all the links of coal production, distribution, transport, and consumption.

3. Improve management work over coal supply and demand.

Various measures should be employed that include economic measures, administrative measures, legal measures and ideological and political work measures to strengthen management work over coal supply and demand. There now is an urgent need for formulation of "Conditions for Signing and Fulfilling Coal Production and Transport Contracts" and the most feasible coal price management methods. We must improve the quality of coal products and develop research on the comprehensive utilization of low quality coal. Unified distribution coal should implement fixed site and fixed amount supplies to establish sales outlets, and we should work toward gradual implementation of commodity coal distribution and price formation.

4. Strengthen coal conservation work and improve the utilization results of coal.

The utilization efficiency of coal in China is very low and there is great potential for energy conservation. The improved supply and demand situation for coal does not mean that conservation can be abandoned. We must be resolute in implementing the energy conservation principles of the CPC Central Committee and continue to focus on transformation and renewal of low efficiency boilers, develop heat equilibrium, extend advanced energy conservation technologies, develop matchup of power and coal and so on to achieve the energy conservation criteria of the Seventh Five-Year Plan and make a contribution to development of the national economy.

12539/6662
CSO: 4013/99

NORTHEAST AIMS FOR SELF-SUFFICIENCY IN 5 YEARS

OW210210 Beijing XINHUA in English 0200 GMT 21 Jul 86

/Text/ Beijing, 21 Jul (XINHUA)--The northeast China area is striving to achieve self-sufficiency in coal in the coming 5 years, according to today's overseas edition of PEOPLE'S DAILY.

During the period, the area is expected to expand coal production by more than 40 percent. This means that by 1990 it will have a total annual production capacity of 140 million tons.

The area, covering Heilongjiang, Jilin, and Liaoning provinces, and the eastern part of the Inner Mongolia Autonomous Region, has had to get about 20 million tons of coal from Shanxi Province, China's leading coal producer, and other areas every year in the past.

Northeast China has verified coal reserves of 63 billion tons, some 40 billion tons of which are located in the eastern part of Inner Mongolia.

During the next 5 years, 19 mines now under construction will be put into operation, increasing annual production capacity by 22 million tons. Production capacity of another 20 million tons will come from technical transformation and expansion of 26 existing mines.

At the same time, 18 new mines with a total design production capacity of 32 million tons a year will begin construction.

Huolinhe and Yiminhe, two opencast mines in Inner Mongolia, will expand to produce 6 and 4 million tons a year respectively, before 1990 from the present 3 and 1 million tons.

/12228
CSO: 4010/67

BRIEFS

NEW NEI MONGGOL MINE--China will begin construction of a new open-cut coal mine in southwest Inner Mongolia Autonomous Region during the 1986-90 period, a regional official said here today. The Jungar coal field has verified reserves of 26.8 billion tons of coal for industrial use. The shallow, thick coal seam is suitable for open-cast working. The first phase is scheduled to go into production in 1991 and turn out 15 million tons of coal in 1994. Auxiliary projects to be built include a 284-km railway to the Datong coal mines in Shanxi Province, China's leading coal producer, and a thermal power plant with a generating capacity of 200,000 kW. A mine official said that China is shifting its attention in coal mining development from east to west. /Text/ /Beijing XINHUA in English 0130 GMT 16 Jul 86 OW/ 12228

CSO: 4010/67

HONG KONG PAPER NOTES 'DISAPPOINTMENT' IN CHINA'S OFFSHORE DISCOVERIES

HK100854 Hong Kong SUNDAY MORNING POST in English 10 Aug 86 Money Post p 2

/Excerpt/ The initial euphoria over China's offshore oil prospects has now been transformed into profound disappointment.

Since the second round of bidding closed in August last year, only seven new contracts have been signed, compared with 19 after the first round in 1982.

Drilling of more than 40 wildcats in the South China Sea has yielded nine oil or gas discoveries.

In the Yellow Sea, five wells have registered oil or gas shows, but where some estimate of reserves has been made, no field can be regarded as commercial at present prices.

The situation led one senior executive to comment: "The oil industry collectively has not worked up any enthusiasm for China."

But is there any justification in writing off such a huge area on the basis of only some 40 wells?

A similar philosophy applied to an area with comparable drilling density in the North Sea or anywhere else in the world is regarded as sacrilege by many oil industry thinkers. Chinese officials have been quoted as saying the companies expected too much too quickly.

However, according to many who have worked in Chinese oil exploration, structures in the South China Sea are larger and less complex than in the North Sea, sediments are very young, and there appears to be insufficient source rock--the strata which generate hydrocarbons.

It is doubtful whether ARCO's Yacheng gas discovery can be developed commercially. According to some sources, the project is under way in the hope that it will be justified through future discoveries in the area.

The oil that has been found is extremely waxy, making production difficult. Its low gas contents makes the situation even worse.

The ACT (Agip, Chevron, and Texaco) group's Huizhou oil discovery, believed to hold reserves of 80 million barrels, is also reported to be uncommercial at current prices.

Any oil accumulations which may be found in the future are expected to be less than 100 million barrels. Companies say that all the large structures--"the golden babies"--have been drilled.

China has taken some steps to liberalize its fiscal terms, including the elimination of the 12.5-percent royalty on production less than 20,000 barrels per day. It is also considering ways of reducing the state take in any find in order to improve the economics of small to medium-sized fields.

China has also opened 10 provinces south of the /Chang Jiang/ and Xinjiang, for onshore exploration in cooperation with foreign companies. According to Ministry of Petroleum statistics, the total area available is 1.8 million square km.

However, are the companies descending in droves to exploit this immense potential? The answer is "no." Only the U.S. independent is believed to be in the final stages of negotiating for acreage in the Sanshui basin in Guangdong province.

Any operations in onshore China would have to start from scratch.

The huge initial investment required nowadays is regarded as almost the exclusive preserve of large companies. And even they are having second thoughts about taking such risks under present market conditions.

But privately, some company representatives are quite blunt about the difficulties they have faced in even obtaining sufficient information to assess prospects in onshore China.

They complain that the national oil company has been withholding selected information from certain companies, and that the Ministry of Petroleum and the Ministry of Geology are competing against each other.

Onshore production is currently in the hands of autonomous provincial oil companies. According to the same industry sources, these companies, quite understandably, have no desire to lose their autonomy, either to a central ministry or to foreign companies.

They also are selective in what they show foreign companies, and they compete against one another, as well as against the ministries.

As China's oil and gas production targets will be difficult to meet as the larger fields are depleted and medium-term exploration prospects are grim, its sentiments to OPEC about production cuts appear to be an expression of Hobson's choice.

Many experts in the oil industry are united on their prime choice of exploration acreage--Saudi Arabia and Iraq--where there are still considerable reserves to be discovered. But as this is a political impossibility, they are forced to take a much inferior second choice.

/12228
CSO: 4010/70

DAQING'S PRODUCTION OVER PAST 10 YEARS REVIEWED, FUTURE OUTPUT PROJECTED

Daqing YOUTIAN DIMIAN GONGCHENG [OILFIELD SURFACE ENGINEERING] in Chinese
Vol 5, No 1, Feb 1986, pp 1-3

[Article by Li Yugeng [2621 5713 1649], director of Daqing Petroleum Administration Bureau and Senior engineer: "Sum Up the Experience of Stable Production in Past 10 Years, Persist in Reform and Work for Another 10 Years of Stable Production of 50 Million Tons a Year"]

[Abstract] This article gives a general account of the basic case of Daqing Oil Field in its 10 years of stable production and the level of oil field development it has reached. It sums up the basic experience in realizing these 10 years of stable production and briefly describes the plan for another 10 years of stable production and tentative ideas to the year 2000.

[Text] Daqing Oil Field has had an annual crude oil output of 50 million tons for 10 years since 1976. The central task it now faces is to earnestly sum up the experience of these 10 years of stable production, unify the ideology of all levels of leading cadres and the broad masses of staff and workers with the spirit of the party congress and with the goal of struggling for another 10 years of stable production of 50 million tons a year.

Daqing Oil Field was first developed in June 1960. So far, 20 il fields have been verified or basically verified, 7 of which including Lamadian, Sa'ertu, Xingshugang, Taipingtun, Gaotaizi, Putaohua, and Xingxi have been put into full-scale development, and others such as the Longhupao oil field are being developed and constructed. The geological reserves put into development make up 93.9 percent of the verified and basically verified reserves.

By the end of 1985 the cumulative output of crude oil in the oil field as a whole was 792 million tons, recovring 18.4 percent of the geological reserves. The year-end average daily oil output was 150,020 tons, with a daily output of 449,000 cubic meters of water and an overall water content of 73.2 percent.

The cumulative total output of crude oil during the 10 years of stable production was 518 million tons, which was equivalent to 1.89 times the total

crude oil output of the previous 16 years (1960-1975), thereby fulfilling a cumulative total of 36.5 billion yuan turned over to the higher authorities, which is equivalent to 1.41 times the total amount turned over during the previous 16 years. Together with the previous 16 years, the cumulative total turned over to the higher authorities was 62.3 billion yuan, or 20.3 times the total invested in Daqing by the state during the same period. During the 10-year period, a cumulative 117 million tons of crude oil were exported, which earned the state approximately U.S.$22.19 billion in foreign exchange.

During the past 10 years the broad masses of cadres and people of the oil field have carried forward the revolutionary and death-defying spirit, adhered to a scientific attitude, overcome many difficulties, completed a fairly large volume of work and reliably kept a stable output of 50 million tons a year. During the 10-year period the total work volume in prospecting, stable production and construction of outlying areas was equivalent to 3.9 times the total work volume of the previous 16 years.

The triumphant realization of 10 years of stable production proves that the methods used in developing Daqing Oil Field and the technology and techniques adopted are successful, and that it level of comprehensive oil field development has already joined the ranks of advanced oil field development in the world:

First, it has created a set of methods for studying oil reservoirs. Daqing Oil Field is of inland lake basin river-delta sedimentation. In the research on oil strata, the theory of sedimentary facies has been introduced on the basis of former small reservoir comparison and oil sand study. Through detailed analysis studies of sedimentary facies of various small reservoirs, it has clarified the sand distribution and composite types of each facies area, established sedimentation models of various types of sand bodies and revealed the relationship between oil-water distribution and anisotropy of different oil reservoirs, thereby guiding oil field development and readjustment.

Second, it formed a complete set of methods of "exploitation by detailed analyses, stable production by continuous substitution" for anisotropic continental oil fields with high oil-bearing reservoirs. In the course of development, it has adhered to the principle that one step in practice is a step in understanding and a step forward; insisted on water injection to maintain oil reservoir energy; and insisted on repeated distribution of wells, analyzing strata in details, readjusting and exploiting potential of separate reservoirs, transferring and substituting output, thereby assuring high and stable yield over a long period of time.

Third, it has developed a set of "exploitation techniques for high water-cut period" that suits the reality of Daqing Oil Field. It essentially includes techniques to monitor the state of oil field development, techniques of detailed analysis of strata and readjustment of exploitation of potential

in oil field development, techniques evaluating the results and calculating targets of oil field development by water injection, complementary techniques for recovery technology during high water-cut period, well drilling and well completion technology for readjustment wells, and surface engineering and techniques for conserving energy and lowering consumption. On the whole these techquiues are up to advanced international levels, which formed production capability after they were popularized and used in the oil field, assured stable production of the oil field during the Sixth Five-Year Plan period and has technically prepared the extension of stable production into the period of the Seventh Five-Year Plan.

Fourth, the oil field has always maintained effective water-driven recovery which is advantageous to improving the recovery ratio. During the stage of exploiting gusher wells, the oil field had always maintained vigorous production capability. After the conversion of gusher wells to pumping wells the pressure system was rationally adjusted so that reservoir pressure was still kept close to the initial pressure, thereby making the utilization of oil reservoir energy even more rational, which is also advantageous to improving the recovery ratio of water-driven recovery.

Fifth, a great deal of first-hand sources have been obtained in the course of oil field development, giving us a better understanding of oil-water distribution at various stages of exploitation and making the result of development and readjustment definite. After detailed analysis of strata and readjustment by close-spacing of wells in the oil field the extent of water control reached 80 to 85 percent, creating favorable conditions for obtaining a relatively high ratio of recovery; initial water content of readjustment well are generally under 30 percent and the average daily oil output of individual wells is 15 to 20 tons, which meet design requirements. During the Sixth Five-Year Plan period, the average annual increase in recoverable reserves was 50 million tons and the rate of increase of oil field water content is controlled at around 2 percent.

Sixth, stable production of 50 million tons a year has been realized for 10 successive years with some increase each year, and the period of stable production of the oil field can still be extended into the future. In 10 years, an additional 18 million tons have been produced based on the required stable production of 50 million tons a year and relatively good economic results have been obtained.

In the course of realizing the oil field's stable production for 10 years, a great deal of work has been done in every aspect and some experience has been accumulated and summarized as follows:

1) Proceeding from large continental sandstone oil fields, we have formulated the guiding principles for oil field development and technical policies for different developmental stages, ensuring stable production of the oil field;

2) We have always persisted in basing ourselves on fundamentals, continuously enhancing our understanding of oil reservoirs to guide development and readjustment;

3) Developing oil fields based on science is the key to achieving sustained stable production;

4) We have actively launched consolidation and persisted in reforms, tried hard to intensify management and administration, and served to realize stable oil field production and improve economic results;

5) A guarantee to achieving stable oil field production is to intensify party leadership, stress building the two civilizations at the same time, and try hard to build a contingent of staff and workers with ideals, morality, education, and discipline.

This experience still needs to be continuously enriched and developed in the work of oil field development in the future.

Recently, leaders of the State Council and the leading party group of the Ministry of Petroleum Industry have set forth new strategic goals for Daqing Oil Field in accordance with the spirit of the party Central Committee's proposed Seventh Five-Year Plan. They can be summarized into three goals: 1) stabilize the annual production of 50 million tons of crude oil for another 10 years; 2) intensify oil-gas prospecting, find another Daqing Oil Field by the year 2000; 3) intensify construction of the petrochemical industry and assure the supply of raw ethylene materials. In accordance with these requirements combined with the realities of Daqing Oil Field, we have drawn up the preliminary plan for another 10 years of stable production and tentative ideas to the year 2000.

The objective of the plan is: another 10 years of stable output of 50 million tons a year in the Daqing oil area. Work for crude oil output should be arranged on the basis of 55 million tons, of which the output of Daqing's Changyuan will be gradually adjusted to 50 million tons and the output of outlying oil fields will be increased to 5 million tons year by year. By the year 2000, find another Daqing Oil Field, that is, in the medium shallow and deep strata north of the Songliao Basin and its outlying basins with a new cumulative geological oil reserves of around 2.5 billion tons, which is equivalent to Daqing's geological oil reserves reported to the state in the early phase of its development.

Guided by the objectives of the overall plan, the preliminary plan for another 10 years of stable production has been drawn up. This plan is divided in two separate stages of the seventh and eighth five-year plans.

The primary tasks in oil field production and construction during the Seventh Five-Year Plan period are: 1) continue to implement the guiding principle of stable production, realize the oil field's long-term stable production; 2) intensify oil-gas prospecting, expand reserve resources; 3) persist in keeping prospecting and exploitation on-going, speed up the construction of outlying oil fields; 4) continue to promote technological transformation of oil field surface engineering, realize low-wastage and low energy consumption as well as the comprehensive utilization of natural gas; 5) rely on scientific progress to solve technical problems and ensure the oil field's sustained stable production; 6) persist in doing a good job in

reforms, continuously increase the vitality of enterprises; 7) speed up the training of qualified personnel, improve the quality of the staff and workers contingents; 8) on the basis of production and development, gradually improve the material and cultural life of staff and workers.

The planned work volume for the Seventh Five-Year Plan is close to the total work volume completed during the 26 years since Daqing Oil Field was first developed and is 1.6 times the planned work volume for the Sixth Five-Year Plan.

By the end of 1990, the cumulative oil output of Changyun in Daqing will reach 1.058 billion tons with an overall water content of about 83 percent. The output of old wells of Lamadian, Sa'ertu and Xingshugang oil fields prior to 1990 will decrease from 49.2 million tons to 34 million tons and the output of southern Changyun will decrease from 2.8 million tons to 2 million tons. Based on demanding a stable production of 50 million tons a year in Changyun, a compensating output of 14 million tons will be needed. Therefore, to maintain stable production during the Eighth Five-Year Plan period, we will have to take such key measures as drilling strata analyzed readjustment wells and secondary perfected and closely-space readjustment wells, and changing pumps and forms of mechanical recovery wells.

After achieving the planned goal of another 10 years of stable production by the end of 1995, we will again strive to continue stable annual production of 55 million tons of crude oil in the Daqing oil area to the year 2000. Calculating on the basis of Changyun's existing exploitable reserves in Daqing, it will be rather difficult to maintain continued stable production in the Ninth Five-Year Plan period and we must adopt some new measures to exploit potential and increase recoverable reserves.

Stable production will be most difficult in the last 5 of the next 15 years. By that time, there will be little increase in oil output by chaning pumps and fracturing old wells, and compensation for production will mainly rely on measures such as secondary closely-spaced wells and improving recovery ratio by water injection in the oil-thick strata.

Regardless of the duration of stable production and the amount of recoverable reserves recovered, realization of stable production to the year 2000 in Daqing Oil Field is rarely seen among oil fields in the world. Much of the technology and techniques that must be tackled in realizing stable production are technical problems that still remain untackled in the world.

Nevertheless, we believe that on the basis of summarizing 26 years of our work in oil field development particularly the 10 years of stable production, guided by the correct party line and the leadership of the heilongjiang provincial party committee, provincial government and the Ministry of Petroleum Industry, only if we adhere to the "two views" as guidance, carry forward Daqing's fine tradition, respect science, act according to the

objective laws of oil field development, persist in reforms, open new frontiers and go forward, we are bound to be able to create oil field development methods as well as the technology and techniques for exploiting potential during super-high water-cut periods, scale new heights in oil field development, and make new contribution to the development of China's oil industry.

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CSO: 4013/118

OIL AND GAS

SHENGLI COULD TOP 350 MILLION BBL A YEAR BY 1990

OW011229 Beijing XINHUA in English 1106 GMT 1 Aug 86

/Text/ Jinan, 1 Aug (XINHUA)--Shengli oil field, China's second largest making steady progress towards the projected goal of catching up with g in output, a goal set by party leader Hu Yaobang.

While touring the area 2 years ago, Hu called on workers there to work hard and build their oil field into "another Daqing."

Daqing, in northeast China, provides half of the country's annual output of crude oil. Shengli produced 189 million bbl last year, about one-fifth of the nation's total, and its 1986 target is 210 million bbl, local officials told XINHUA.

Shengli should be producing 350 million bbl in 1990--the present annual output of Daqing, the officials said.

Altogether 50 oil zones have been found in the area, which is better known as the /Huang He/ Delta.

Of these, 32 are producing, including one that was put into operation last month which produces a daily average of 70,000 bbl.

The oil field has produced 1,904 million bbl of oil and 15.3 billion cubic meters of natural gas since 1964, when production began.

The taxes and profits Shengli has turned over to the state were 5.4 times that of the state investment of 2.8 billion yuan, and a total of 259 million bbl of oil has been exported since 1974, the officials added.

Science /and technology/ would be crucial to achieving the goal of catching up with Daqing, the officials said.

The officials cited the example of a new soil exploration theory developed by Chinese scientists, which led to the discovery of oil pools in places believed to have no oil.

In line with the theory, technically known as the "composite oil and gas reserves" theory, geologists have come to the conclusion that the bulk of the area is rich in oil and gas.

Automatic control apparatus are being used for practically all major operations in oil production, including all extraction and measurement, the officials said.

And more than 100 items of advanced technology have been used in oil drilling, saving the oil field about 100 million yuan.

/12228
CSO: 4010/70

SICHUAN GAS OUTPUT UP 6 PERCENT OVER 1985

OW250036 Beijing XINHUA in English 2340 GMT 24 Jul 86

[Text] Chengdu, 24 Jul (XINHUA)--Sichuan Province, China's largest natural gas producer, turned out 2.9 billion cubic meters of natural gas in the first 6 months this year, up 6 percent over the same period last year.

An official of the provincial petroleum administration said here today that the natural gas output this year is expected to account for a half of the country's total.

To prospect for more natural gas deposits, the province is cooperating with American and French companies in the eastern, southern, and northwestern parts of Sichuan.

A total of 200 million yuan will be spent on importing technology and updating the existing equipment here in the 1986-90 period, double the figure for the previous 5 years.

Natural gas reserves, verified on one-third of the provincial territory of 560,000 square kilometers, account for a half of the country's total. Last year saw the province produce 5.5 billion cubic meters, one-fourth of the country's total.

According to the official, Sichuan is concentrating its efforts on opening the natural gas fields in the eastern part of the province.

China has reserves of at least several trillion cubic meters of natural gas, which will be the country's top energy priority through to the end of the century, according to an earlier report.

/12624
CSO: 4010/68

OIL AND GAS

BRIEFS

OIL PRODUCTION INCREASE--Beijing 21 Jul (XINHUA)--China produced 439.46 million bbl of crude oil in the first 6 months of this year, a 2.2 percent increase over the same period of last year. Daqing oil field, the country's leading oil producer, produced more than 192.57 million bbl, while Shengli oil field, the No 2 oil producer, produced over 93.66 million bbl during the period. Also, China has produced some 6.69 billion cubic meters of natural gas, 270 million cubic meters more than in the same previous period. /Text/ /Beijing XINHUA in English 1446 GMT 2 Jul 86 OW/ 12228

NEW HENAN FIND--Zhengzhou, 5 Jul (XINHUA)--A thick oil field, believed to be the biggest discovered since 1980 in China, has been found in Nanyang Prefecture, Henan Province. Oil reserves are so far verified at 292.6 million bbl, in an area of 16.2 square km, local officials said today. But work is continuing to find new reserves. Experts believe the oil field would eventually promise something about 700 million bbl. Most reserves are in shallow strata, "easy to exploit," the officials said. /Text/ /Beijing XINHUA in English 0959 GMT 5 Jul 86 OW/ 12228

JILIN OIL-BEARING STRUCTURE--Changchun, 29 Jul (XINHUA)--A geological structure, thought to have enough oil and natural gas for industrial exploitation, has been found in the Songhua-Liohe River Plan, northeast China, according to local officials. A well, drilled on the structure 67 kilometers form this capital of Jilin Province by a team from the Ministry of Geology and Minerals, produced oil and gas last week. Petroleum specialists said the discovery may lead to a jump in oil production in the northeast. The structure, formed in the Early Cretaceous period (approximately 136 million to 65 million years ago), is 20 to 30 million years earlier than the oil-bearing structures already found in the area. The ministry has planned several wells in the area in order to verify oil and gas reserves. There are several oil fields in the region, including Daqing, China's leading one. [Text] [Beijing XINHUA in English 0747 GMT 29 Jul 86 OW] /12624

DAGANG PRODUCTION UP--Beijing, 2 Aug (XINHUA)--Dagang oil field near Tianjin, one of the major industrial cities in north China, produced 15,540,000 bbl of oil in the first 7 months of this year, up 6.1 percent over the same period of last year. An oil field official attributed the result of applying advanced technology and equipment. /Text/ /Beijing XINHUA in English 1206 GMT 2 Aug 86 OW/ 12228

CSO: 4010/70

CPC LEADERSHIP SAID SENSITIVE TO DAYA BAY CRITICISM

HK011315 Hong Kong CHENG MING in Chinese No 106, 1 Aug 86 pp 6-8

["Notes on a Northern Journey" by Lo Ping [5012 0393]: "Zhao Ziyang's Brain Trust Advocates Halting Construction of Nuclear Plants"]

[Text] Deng's and Hu's "Basic Views" are Identical

What is the reaction of the CPC's top echelons to the Hong Kong people's demand for a halt in the construction of the Daya Bay nuclear power plant?

As everyone knows, the CPC is still basically practicing the patriarchal system or engaging in the practice of "what one person says goes." What Deng Xiaoping says often becomes a policy or a final decision.

Has Deng Xiaoping said anything about the Daya Bay nuclear power plant?

It is reported that neither Deng Xiaoping nor Hu Yaobang have any specific views about nuclear energy. Their general views are: First, we are not blindly opposed to it and second, we should attach importance to safety.

When the secretariat of the CPC Central Committee held a meeting to discuss nuclear energy, Hu Yaobang aired the above-mentioned two "basic views." Deng Xiaoping's "basic views," which Hu relayed at the meeting, were also the same.

The Practice of "What One Person Says Goes" Also Changes Sometimes

Deng Xiaoping and Hu Yaobang have expressed their "basic views" in general terms. They do not seem to be in contradiction with the "basic views" of the Hong Kong people.

The Hong Kong people are not blindly opposed to nuclear power plants; they are only opposed to the construction of a nuclear power plant at Daya Bay. If the CPC chooses another site for the nuclear plant, which is a long distance from Hong Kong and which will not affect Hong Kong or make it easier for Hong Kong to meet a contingency should an accident happen it is believed that the Hong Kong people will not be opposed to it.

Of course, the Hong Kong people attach great importance to safety and call for ample safety measures in the construction of a nuclear plant. However, if a nuclear plant should be close to Hong Kong, they will take a sceptical attitude toward the feasibility and effectiveness of all safety measures.

In spite of Deng Xiaoping's and Hu Yaobang's views, I think Zhao Ziyang's view is very important.

The practice of "what one person says goes" has always been a common one in the CPC. But sometimes it is not so. This is a good phenomenon.

The Sanxia Project Is a Case in Point

On the question of the Sanxia project, Deng Xiaoping has said that it has "more advantages than disadvantages." Despite these words, the plan to establish a Sanxia Province has been given up. A friend working in the preparatory organization for the setting up of a Sanxia Province recently told me: "The organization has been disbanded and I am out of work." More important, it has been decided that the construction of the Sanxia project will be delayed until further studies and designs.

The big turn, or about-face, from getting ready to develop the Sanxia project to basically giving up its development, is inseparable from Zhao Ziyang.

Zhao Ziyang's objection to hurriedly developing the Sanxia project is also inseparable from the view of his brain trust.

Naturally, the views of the masses and the CPPCC have also played their parts.

The principal view of the brain trust, experts, and masses is that the Sanxia dam project will bring about a chain reaction on a series of questions, such as the ecology, environment, and natural resources of the entire Chang Jiang basin. The soil in a vast expanse of cultivated land will go bad, the areas producing industrial crops will suffer heavy losses, and some 10-20 counties will be inundated, making it necessary to move as many as 1 million people. The losses caused by the inundation will be greater than any other large reservoir in other parts of the world. Moreover, many key places of historic interest, cultural relics, and scenic spots will be swept away. The Sanxia project will also bring about catastrophic earthquakes. If a war breaks out, the Sanxia project will become a target of attack...

Zhao Ziyang Has Influenced Deng Xiaoping

Zhao Ziyang was the first to accept the views of the brain trust, experts, and the masses. He later succeeded in winning over Deng Xiaoping's approval to postpone construction of the project.

This is a gratifying situation, which is vastly different from the construction of the Baoshan Iron and Steel Works. Almost all the relevant engineers in Shanghai were opposed to the construction of the works but their oppostion came to nothing. Clinging obstinately to its course, the CPC Central Committee has incurred enormous losses to the state. By comparison, the CPC has made some progress in its work style and approach toward the Sanxia project.

A Reflection of Differing Views Within the CPC

Naturally, it was not all clear sailing for Zhao Ziyang to prevail over the view to go on with the Sanxia project because Li Peng, as well as his supporters, resolutely advocated developing the project. After a heated dispute between those for and against the project, Zhao Ziyang finally won.

The dispute was also reflected in varying degrees in newspapers and magazines. A newspaper in Beijing reprinted in a conspicuous place an article from a leftwing Hong Kong newspaper advocating the construction of the Sanxia project. But some newspapers and magazines put on a rival show by pushing some data showing that the state was reconsidering or canceling plans for big dams and hinted that the plan for the Sanxia project should be scrapped. This minor "data skirmish" reflected differences of opinion on the Sanxia project within the CPC.

Misguided by Information From Hong Kong

The top echelons of the CPC also have differing views on the question of the Hong Kong people's opposition to the construction of the Daya Bay nuclear power plant.

At first, some senior officials erroneously believed the information from a certain source in Hong Kong, thinking that the call for a halt was issued by some Hong Kong people with "ulterior motives." Later, however, after obtaining first-hand data from relatively neutral newspapers in Hong Kong, they suddenly realized that the opposing views were widespread and that only a small number of people argued in favor of the Daya Bay nuclear power plant. (Editor's note: More than 1 million people have called for a halt in the construction of the Daya Bay nuclear power plant. In the Legislative Council, there are a few at each extreme and many in between. At a Legislative Council meeting, Allan Lee criticized a playbill opposing the construction of the nuclear plant; Martin Lee, however, expressed a differing view. The middle-of-the-roaders have kept silent.)

For this reason, the Hong Kong and Macao affairs office and the Secretariat of the CPC Central Committee cannot but reconsider the issue.

From the publicity posture of the CPC we can feel this trend. It is said that the Propaganda Department of the CPC Central Committee has been instructed to notify press units and relevant institutions, newspapers, and magazines that they should not release or publish without authorization reports or comments on Hong Kong people's reactions to nuclear power plants.

In carrying out publicity toward Hong Kong and abroad, it is necessary to stress the safety of the Daya Bay nuclear power equipment and the safety measures for nuclear power and to be prudent in treating and dealing with opposing views. One should not unwarrantedly stick labels on people who call for a halt in the construction of the nuclear plant.

Zhao Ziyang's Remark

Many cadres in Beijing know that Vice Premier Li Peng likes to show himself off. He hopes to win the premiership in exchange for the great achievements in his official career. For this reason, he resolutely favored the construction of the Sanxia project and the Daya Bay nuclear power plant. They also know that Premier Zhao Ziyang does not approve of the continued development of the Sanxia project. However, they do not have any information about Zhao Ziyang's attitude toward the Daya Bay nuclear power plant.

By chance I met a person working in Zhao Ziyang's brain trust. When I asked him about Zhao's attitude toward nuclear energy, he said:

"On the macro level, Premier Zhao entirely agrees with Deng's and Hu's views: First, we are not blindly opposed to it and second, we should attach importance to safety. On the micro level, the premier has his own view."

"What is his view?"

"Last May, Zhao Ziyang went to Chongqing to inspect the site of the Sanxia Dam. He said to the local people concerned: 'The Sanxia dam is not a technical but a political question. It is a question of what attitude the Communist Party should take toward democracy. What should we do if one-third or two-thirds of deputies should cast dissenting votes when the Sanxia project is put to the vote at the NPC meeting?' We can thus see that Zhao Ziyang attaches great importance to the views of the masses. In truth, the question of the Daya Bay nuclear power plant is no longer a purely technical one. Is it possible that Premier Zhao's attitude toward this question is totally different from his attitude toward the Sanxia project?"

Most People in the Brain Trust ARe Inclined To Stop or Postpone Construction of the Nuclear Power Plant

"Do you mean that so long as the Hong Kong people insist on halting the construction of the Daya Bay nuclear power plant, Zhao Ziyang will comply with the popular will?"

"As Zhao Ziyang's advisors, we are in the majority and we agree with the proposal to find another site for the construction of the nuclear plant. In our view, it is not worthwhile if, because of a nuclear power plant, the Hong Kong people should be worried, causing political instability and even affecting stability and prosperity. In doing so, the economic results will be out of the question and the political results will even be negative. At first, in raising the idea of constructing the Daya Bay nuclear power

plant, one of our motives was to reassure the Hong Kong people. If the result should be contrary to our expectations, it is natural to make a quick turn or at least to give the matter further thought."

"Do you mean halting or postponing the construction?"

"In Cantonese, 'postponing construction' means 'delaying action,' doesn't it?"

From his "treasure box" this frank and straight-forward friend picked up a copy of SHIJIE JINGJI DAOBAO dated 7 July. Handing it to me, he said: "There is a page in it dealing with nuclear energy. You should pay attention to it."

It was a professional newspaper backed by Zhao Ziyang. Some of the writers are fairly authoritative. They are either academics at the Academy of Social Sciences or senior people from the brain trust.

The Trend Is To Halt Constructing the Nuclear Power Plant

The 7 July SHIJIE JINGJI DAOBAO can be regarded as dealing exclusively with nuclear energy on page 13. An article entitled "The Chernobyl Accident and the Secret Worry of High Technology" is featured prominently. There are two paragraphs in it which merit our special attention:

"Since 26 April this year, the literally unknown Chernobyl has immediately become the focal point of world attention. The Netherlands, which is on the eve of general elections, the Philippines under the Corey Aquino government, and socialist Yugoslavia have reacted by postponing or halting their nuclear energy programs; the ruling and opposition parties in Europe have also stepped forward to explain their attitudes toward, and their positions on, nuclear energy."

That is to say, postponing or halting nuclear energy programs has become a trend in the international political arena. A lot of fresh data can be added. One is that Fred Sinowatz, Austrian chancellor and chairman of the Austrian Socialist Party, originally favored the use of Austria's only nuclear plant, which had been completed but which had not been put into operation. However, due to the strong opposition by the masses, he complied with the popular will during the general elections (he wanted to renew his term of office) by renouncing the use of the nuclear power plant.

An Authoritative Publication Affirms the Anti-Nuclear Movement

Another paragraph in this article is even more meaningful: "Compared with spacecraft, nuclear energy technology is considered more mature. It left laboratories long ago and moved toward practical application. It has occupied quite a position in the total generated electricity of many countries. According to statistics, from 1971 to 1984, 151 nontrivial accidents occurred in 14 countries with this 'mature' technology. For this reason, when the Chernobyl accident happened, thousands of nuclear

protesters in Eastern and Western Europe took to the streets. When they held high the placard 'it will be our turn next,' we cannot but say that they have raised a powerful slogan."

Over the past 13 years, 150-odd "non trivial" accidents have occurred in 14 countries. The figure itself is "non trivial" matter. Is the "theory of nuclear safety" tenable in the face of facts? The article has positively appraised ("We cannot but say that they have raised a powerful slogan") the slogan (such as "it will be our turn next") raised at the high tide of the anti-nuclear movement in Europe after the Chernobyl accident. This merits our particular attention. However, if a person should negate the anti-nuclear movement in Hong Kong while affirming the anti-nuclear movement in Europe, would not his logic present a problem and would his article be published in a high-level publication?

It Is Difficult Not To Be Worried About Nuclear Energy Technology and Management

On page 13, SHIJIE JINGJI DAOBAO also carried two articles entitled "Serious Nuclear Accidents Since the 1950's" and "The Effect of the Soviet Nuclear Power Plant Accident on Western Countries." The former was a translated version of selected passages from MOSCOW NEWS and the latter was extracts from a TIMES article. The TIMES carried the article with the aim of showing that the Soviet nuclear disaster did people great harm and the MOSCOW NEWS carried the article with the aim of showing: "You see, nuclear accidents have not happened in the Soviet Union alone, they have likewise happened in the United States, Britain, Germany, and France." The publication of these data in SHIJIE JINGJI DAOBAO shows that nuclear energy technology and management have not reached such a level as to make people feel at ease.

It is also interesting to note that a picture of anti-nuclear demonstrations in Britain was published on this page. The caption is: "The members of London Environmental Organizations took to the streets, calling for a halt in the building of new nuclear reactor installations. The slogans read: Three Mile Island, Chernobyl, How Many Nuclear Accidents Will There Be?"

From SHIJIE JINGJI DAOBAO alone we can also see that Zhao Ziyang's brain trust agrees to halt or postpone constructing the Daya Bay nuclear power plant.

So Long as Hong Kong Persists in and Strongly...

Naturally, like the question of the Sanxia project, the people in the CPC's top echelons who approved the construction of the Daya Bay nuclear power plant are still fairly stubborn. Some newspapers and magazines have carried an article entitled "The Nuclear Power Plant Is not an Atom Bomb" and the party's mouthpieces have also published a series of articles and

data on nuclear safety. This precisely shows that some people in the top echelons are so impenetrably thickheaded that they do not want to "retract their order" in spite of the popular will.

I believe, however, that after his return from abroad, Zhao Ziyang will take into serious consideration the views of his brain trust and the Hong Kong people.

I also believe that so long as the Hong Kong people persist in, and strongly express, their demand for halting the construction of the Daya Bay nuclear power plant, they will not achieve nothing. The question is whether they can persist in it and strongly express it.

I ask a blessing for the Hong Kong people--The three characters meaning Daya Bay will be removed from the nuclear power plant blueprint.

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NUCLEAR POWER

REGULATIONS ON NUCLEAR POWER PLANT SAFETY ISSUED

HK180307 Beijing CHINA DAILY in English 18 Jul 86 p 1

/Article by staff reporter Wu Jingshu/

/Text/ China has put into force its first sets of safety regulations for nuclear power stations, according to the National Nuclear Safety Administration.

The four sets of regulations govern the siting, design, operation and quality control of nuclear power stations.

"These regulations will be immediately enforced at the Qinshan and Daya Bay nuclear power projects now being built in Zhejiang and Guangdong provinces to guarantee their absolute safety," Dong Bonian, deputy chief engineer of the Nation Nuclear Safety Administration, told CHINA DAILY.

The design regulations stipulate that multiprotective shields must be installed to prevent radioactive fallout as well as listing detailed design requirements for each part of a reactor.

Drawing lessons from the Three Mile Island incident in the United States, the regulations also stipulate that the work environment must be designed in line with the principle of human engineering.

The regulations are the result of a study of all existing standards worldwide, on nuclear safety conducted by Chinese scientists since 1982, under the guidance of the Ministry of Nuclear Industry, according to Dong.

"During these years, we have studied every article of the regulations stipulated by the International Atomic Energy Organization, and consulted a number of Chinese-American nuclear experts and sought the opinions of nuclear safety specialists from France and West Germany," Dong said, "and they have indicated their satisfaction with our draft rules.

"We have considered every possible safety requirement in our current regulation. But if any new measures are recommended by scientists after their study of the recent Chernobyl accident, we will immediately take them into consideration," Dong added.

The regulations were formally approved by the State Council last week, Dong said.

In a related decree, the State Council has designated the National Nuclear Safety Administration responsible for the enforcement of the four sets of safety regulations.

"The safe government of nuclear power, which has just begun in this country, is a matter of great public concern. Therefore, every effective step should be taken to guarantee the principle of quality first and safety first in siting, designing, operating and managing nuclear power stations," the State Council said in a decree.

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PROSPECTS FOR 'SECOND NUCLEAR ERA' DISCUSSED

Chengdu HE DONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 7, No 1, Feb 86, pp 1-8

[Article by Lu Yingzhong [0712 2019 0022]: "The Second Nuclear Era and Prospects for Power Reactor Development"]

[Excerpts] Abstract: The decline of nuclear power in many developed and developing countries is analyzed and the reasons are traced back to their historical origins. The major weakness of current power reactor designs is identified, the negligence of inherent safety features leads to over-redundancy of systems which in turn resulted in huge cost over-runs and long lead time. Various advanced second generation power reactor designs are compared comprehensively, and the line of power reactor development in China is proposed.

China's Prospects for Power Reactor Development in the Second Nuclear Era

China's nuclear power industry is still in its infancy but the "first nuclear era" is drawing to an end on the international scene. As a result, the nuclear power suppliers from various countries are fighting to enter the Chinese market, thereby giving us the opportunity to select the mature and advanced technology and keep the purchase prices down. This is the good side for the rapid development of China's nuclear power. However, looking ahead, we should also realize the other side of the situation. In foreign countries the intrinsic weaknesses of the first generation nuclear power reactors have been realized and various attempts are being made to make fundamental changes to meet the higher challenges placed on the power reactor by the second nuclear era. There is, therefore, a tendency to anxiously get rid of the outdated technology. In the long term, the current PWR technology may be replaced by more advanced reactor technologies in the world market. If we do not catch up with scientific research and technological development, we may still be outdated at the end of the century even if we master PWR technology.

In terms of China's actual needs, some of the characteristics of the second-generation power reactors are particularly well-suited to the energy needs of China. Since the primary energy source in China is coal and 70 percent of the coal is used for heating, the large cities and the industrial zones suffer severe environmental pollution. The long-distance hauling of coal has also been a

burden for the transportation industry. Nuclear power for heating and nuclear electric power are therefore equally important in China's energy system. The nuclear reactors for heating purposes not only have different temperature parameters from a PWR power plant, they must also be located close to big cities and meet even higher safety requirements. Such features are only available on the second generation power reactors. Economically, since the competitors of the nuclear plants are thermal power plants based on cheap coal and hydroelectric power stations built with cheap labor, the large, modern nuclear power plants are at a distinct disadvantage as they requires a hefty investment. Therefore, even though China has yet to enter the first era in nuclear power, proposals have been submitted to develop low-temperature heating reactors for the cities, high-temperature gas-cooled reactors, and medium and small-scale nuclear plants to meet the objective needs. Some research and development ground work have been done for these types of reactors. It is logical and sensible to go from the microboiling natural circulation reactor for heating only to the double layer natural circulation heat-electricity hybrid boiling water reactor, or from the spherical bed high-temperature gas cooled reactor to the modularized spherical bed high-temperature gas-cooled reactor. The development strategy of China's power reactors should therefore consist of two parts:

(1) Import advanced foreign technology for the large-scale pressurized-water reactor to build PWR plants which will serve as the backbone power plants of China's several major power grids in the tens-of-millions-of-kilowatts range and solve the electricity shortage in the eastern region. This is an important approach in nuclear power development.

(2) In the meantime, international cooperation should be developed on the basis of China's own technology. The nuclear reactor technology for heating purposes should be developed, followed by intrinsically safe heat-power dual purpose reactors, to solve the coal shortage and pollution problems in China's major cities and industrial zones. This should be regarded as another important approach in China's development of nuclear power. The latter is closely related to the development of the second nuclear era and advanced reactors abroad. Therefore, the long-term importance of this type of reactor is no less than that of the large-scale PWR nuclear station even though the new reactors are still in the testing and demonstration stage.

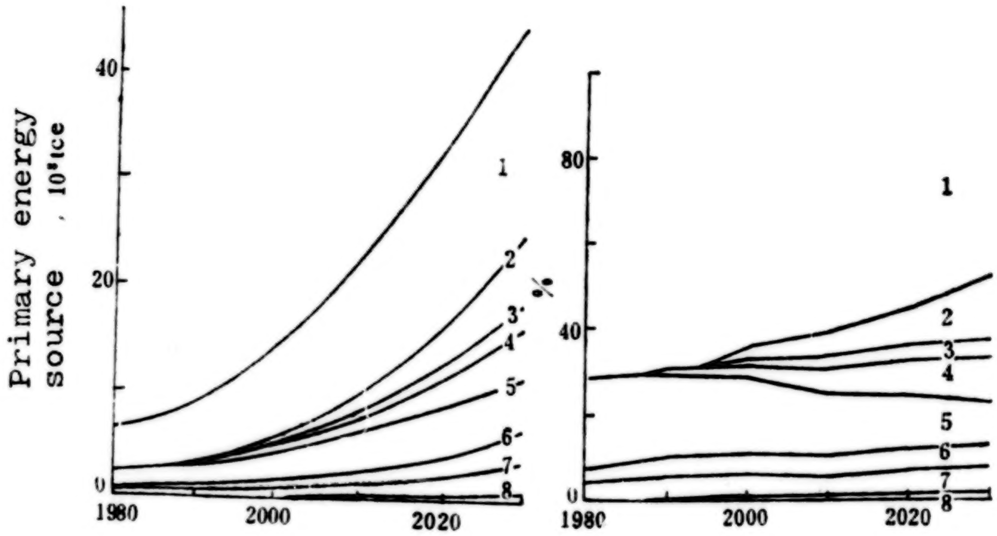

Figure 7. Long-term forecast for China's energy resources and the role of nuclear energy

Key:

1. Coal
2. Nuclear electric power and thermal electric power
3. Nuclear heating
4. Petroleum (unconventional resource)
5. Petroleum (conventional resource)
6. Natural gas
7. Hydroelectric power
8. Other regenerative energy resources

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